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THIRTY-SEVENTH MEETING OF THE AMERICAN ASTRONOMICAL SOCIETY.

The thirty-seventh meeting of the Society was held in affiliation with the American Association for the Advancement of Science at Philadelphia from December 28 to 30, 1926. Headquarters were at the Hotel Walton, while scientific sessions were held in Bennett Hall of the University of Pennsylvania.

The first day, Tuesday, was left open for members to visit other sections. In the morning they were pretty well scattered, but in the afternoon most of them attended the joint session of Section B and the American Physical Society to hear the address of the retiring vice-president, H. M. Randall, on "Infra-Red Spectroscopy," and another address by W. F. G. Swann on "The New Quantum Dynamics."

Wednesday was a full day for the astronomers; there were morning and afternoon sessions for papers. In the absence of President Comstock, the presiding officers were Messrs. S. A. Mitchell and Frederick Slocum. The afternoon session was a joint meeting with Section D—Astronomy of the Association, when the address of the retiring vice-president, A. E. Douglass, on "Solar Records in Tree Growths" was given. In the late afternoon the meeting adjourned for the members to attend the general session of the Association where the lecture by H. D. Curtis was on "The Unity of the Universe." In the evening there was an informal dinner for astronomers and their friends at the Hotel Walton; Professor Shapley presided as toastmaster.

On Thursday, some of the members made an early start with Professor Barton of the Flower Observatory and inspected the new Delaware River bridge. The morning session was a joint meeting with Section C—Chemistry with a general topic "Cosmic Chemistry." On this program three addresses were delivered: "The Chemistry of the Stars" by H. N. Russell; "The Atmosphere, Bottom to Top" by W. J. Humphreys; and "The Present Condition of Knowledge on the Composition of Meteorites" by G. P. Merrill. In the afternoon was held the final session for papers of the Society, after which a bus load of members made the circuit to the Flower Observatory, then through Haverford and Bryn Mawr to the Sproul Observatory at Swarthmore, where pleasant memories of meetings five and ten years ago were revived, and then back to the city.

The Society is indebted to the local committee of arrangements, under the chairmanship of J. H. Pitman, for the success of the meeting.

The following new members were elected by the Council, making a total of 437 in the Society:

A. Lowell Bennett, Lowell Observatory, Flagstaff, Ariz.
Louis Berman, University of Minnesota, Minneapolis, Minn.
Julius Arthur Brown, Mt. Wilson Observatory, Pasadena, Calif.
Leland E. Cunningham, Box 36, Roxbury, Mass.
G. K. Daghlian, Connecticut College, New London, Conn.
David Dietz, 1146 Cleveland Heights Blvd., Cleveland, O.
Helen M. Mitchell, Observatory House, Wellesley, Mass.
H. W. Mountcastle, Western Reserve University, Cleveland, O.
William Pitt, 1228 Dunford Circle, Kansas City, Mo.
Dolores Poland, Sabetha, Kansas.
Margaret L. Walton, Harvard Observatory, Cambridge, Mass.
Marjorie Williams, Smith College, Northampton, Mass.

Members of the Society present at the Philadelphia meeting were:

Leah B. Allen
D. Alter
Adelaide Ames
L. B. Andrews
Ida Barney
S. G. Barton
L. A. Bauer
Maude Bennot
Harriet W. Bigelow
E. W. Brown
Annie J. Cannon
H. D. Curtis
R. H. Curtiss
G. K. Daghlian
D. Dietz
R. S. Dugan
W. S. Eichelberger
H. B. Evans
Priscilla Fairfield
J. W. Fecker
P. Fox
C. H. Gingrich
W. M. Hamilton
M. Alberta Hawes
Margaret Harwood
H. B. Hedrick
Laura Hill
Helen M. Howarth
L. G. Hoxton
M. F. Jordan
Florence P. Lewis
Hazel M. Losh
Mrs. Percival Lowell
D. B. McLaughlin
E. S. Manson
R. W. Marriott
Antonia C. Maury
C. E. K. Mees
W. I. Milham
S. A. Mitchell
H. R. Morgan
F. R. Moulton
J. J. Nassau
C. P. Olivier
G. F. Paddock
J. Pawling
Cecilia H. Payne
E. C. Phillips
J. H. Pitman
C. L. Poor
E. D. Roe, Jr.
J. T. Rorer
H. N. Russell
F. H. Safford
J. Schilt
A. C. Schock
H. Shapley
F. Slocum
C. E. Smith
J. A. Snyder
M. B. Snyder
C. L. Stearns
J. Stebbins
H. T. Stetson
J. Q. Stewart
R. M. Stewart
J. Stokley
O. Struve
A. B. Turner
A. Vyssotsky
Margaret Walton
W. R. Warner
Helen Whitaker
E. Williams
Marjorie Williams
J. E. Willis
Anne S. Young
Jessica Young

It was announced that future meetings had been fixed by the Council as follows: 1927 September, at Madison, Wisconsin; 1928 December, at New York City. The places of the winter meeting of 1927 and the summer meeting of 1928 are still to be determined.

ABSTRACTS OF PAPERS

ABSOLUTE MAGNITUDES AND PARALLAXES OF 412 M-TYPE STARS.

By W. S. Adams, A. H. Joy, and M. L. Humason.

This investigation contains the results of a study of 100 dwarf stars of type M and 312 giant stars, comprising essentially all of the giant stars of this type listed in Boss's Catalogue north of —30°. The dwarf stars were selected on the basis of proper motion, but no selection was made in the case of giants. The list also includes a number of stars in Kapteyn's Selected Areas and some of the irregular variables in the Perseus Cluster.

The stars have all been classified into the spectral types M0, M1, M2, etc., in accordance with the intensity of the titanium-oxide bands. No type has been found more advanced than M7 among the giants and M6 among the dwarfs. As is well known, the long-period variables have more advanced spectral types and would complete the sequence between M7 and M9 for the giant stars. In the case of the dwarfs it seems probable that stars of type later than M6 would be of such faint apparent magnitude that they have not as yet been observed.

The derivation of the absolute magnitudes of the dwarf stars has been made from correlation curves between absolute magnitude, as derived from trigonometric parallaxes, and the intensity of the calcium lines λλ4318, 4435, 4455, and 4586, the titanium blend at λ4535, and the low-temperature strontium line at λ4607. The intensities of all of these lines increase with decreasing luminosity. For the giant stars similar correlation curves have been made for the low-temperature iron lines λλ4207, 4258, 4389, and 4489, the hydrogen lines Hγ and Hβ, and the ionized strontium line at λ4077. No trigonometric parallaxes, however, have been used in the computation of the mean absolute magnitudes, the results being based entirely upon peculiar motions. An investigation by Strömberg has shown that in the case of stars with considerable peculiar motions such as the M-type giants, these yield much more consistent values for mean parallax than do the parallactic motions so often employed in the absence of radial velocity data.

The results show the existence of a class of very bright stars, 28 of which have absolute magnitudes brighter than —1.0. These stars have a pronounced galactic concentration, the average latitude being 7°, although M-type giants in general show little or no concentration. This effect is similar to that found among the "super-giant" stars of other spectral types.

The mean absolute magnitude of the normal giant stars is about —0.2 and the dispersion is small. The faintest star among the early M-type giants is +0.7 and the brightest dwarf is +6.9, thus leaving an in-

terval of 6.2 magnitudes in which no stars are found. For stars of type M5 or later, this interval increases to 11.1 magnitudes. The giant stars show little variation in absolute magnitude with advancing spectral type but the dwarf stars decrease rapidly in brightness. Among the giants less visual radiation at lower temperatures seems to be compensated by increased size, but among the dwarfs no such effect is present and the luminosity falls off rapidly.

The trigonometric parallaxes of 71 of the giant stars in the list have been measured, and a comparison with the spectroscopic values shows the latter to be slightly less than 0".001 smaller in the mean. This would make the average spectroscopic absolute magnitude about 0.2 magnitude brighter than the trigonometric. Since no use was made of trigonometric parallaxes in the derivation of the reduction curves, this comparison affords good independent evidence for the accuracy of the spectroscopic reduction system. For the dwarf stars a comparison for 64 stars shows the mean spectroscopic value to be about 0".002 smaller than the trigonometric. Close agreement is to be expected for these stars since trigonometric parallaxes were used in the calibration of the reduction curves.

A comparison of these results with those of other observers shows a difference of about 0.8 magnitude for 86 giant stars observed by Young and Harper, and 0.7 magnitude for 47 stars observed by Rimmer, the Mount Wilson absolute magnitudes being the fainter. In both cases the agreement is much closer for stars of early spectral subdivisions than for those of later type.

Our reductions have been made with the use of different correlation curves for different spectral subdivisions while the other observers have used the same curves for all the stars. Another source of difference doubtless lies in the fact that the mean absolute magnitudes for calibration purposes were calculated from peculiar motions exclusively at Mount Wilson, while other observers have made extensive use of parallactic motions. A comparison of the absolute magnitudes of 155 stars with those published by us in the list of 1646 stars in 1921 shows an average difference of 0.4 magnitude, the present values being the brighter. This result is satisfactory in view of the low weight of the earlier determinations.

A number of dwarf stars have been found by us to have large parallaxes for which no trigonometric measures are as yet available. They were shown in the accompanying slide. The parallaxes of BD—7°4003 and BD—12°4523 would place them among the nearest known stars.

The relationship between spectral type and absolute magnitude is very marked among the dwarf stars of the late K and M types. The accompanying slide showed the correlation as derived from trigonometric parallaxes and our own determinations of spectral type. The dispersion in absolute magnitude in the spectral subdivisions is so small that in the case of very faint stars a parallax of very fair accuracy can be derived from an estimate of spectral type alone.

NOTE ON THE WATER-CELL TRANSMISSIONS OF THE RADIATION FROM SIRIUS.

By W. W. Coblentz.

Through the courtesy of the Lowell Observatory, in 1921 the spectral energy distribution and temperatures of 16 stars were determined by means of a set of transmission screens, which, either singly or in combination, were placed in front of the thermocouple receiver. The water cell and the quartz screen were used separately. The screens used in combination were the water cell with either red, yellow, or blue glass. From a recent checking of these data it appears that when the complete series of measurements was made on Sirius, using all these screens, the quartz plate and the water cell were accidentally placed simultaneously in front of the thermocouple receiver instead of only the water cell. This conclusion is arrived at from an examination of two sets of preliminary observations using only the water cell and only the quartz cell, which data had been overlooked in the previous calculations. The average galvanometer deflections, with and without the water cell interposed were 4.19 and 5.58 cm respectively, giving a water-cell transmission (w.c.t.) of 75.1 per cent, or 81.9 per cent when corrected for reflection of radiation from the windows of the water cell.

Subsequently, using a higher galvanometer sensitivity and the complete series of screens the galvanometer deflections for "no cell" and through the quartz screen were 11 to 12 per cent higher (6.4 and 5.7 cm respectively) whereas the deflection (4.21 cm) observed through the water cell remained unchanged, which might result from poor focusing or the presence of the quartz screen. Correcting this value by 9 per cent for reflection from the quartz plate gives a w.c.t. of $4.58 \div 6.4 = 71.8$ per cent; or 78.5 per cent when corrected, as usual, for reflection from the water cell. If we ascribe this discrepancy to poor focusing and correct the observed deflection (4.21) by 12 per cent as indicated by the measurements of "no cell" and through the quartz plate, the w.c.t. $= 80.5$ per cent, which is in good agreement with the earlier measurements. Using this same radiometric equipment, during the spring of 1925 and again this fall, Mr. C. O. Lampland obtained an extensive series of (unpublished) measurements on Sirius, all of which are in agreement in giving transmissions above 80 per cent, as previously observed on A-type stars.

From the foregoing discussion it is evident that contrary to numerous other binaries observed, the companion star of Sirius contributes but little to the radiation from the primary star. The conclusions of Coblentz and Lampland (*Journal Franklin Institute*, **199**, 790, 1925) that the companion star of Sirius is down to type K must therefore be withdrawn. If the radiometric measurements permit any interpretation it is that the companion star is close to type A, which is in agreement with spectroscopic evidence (Adams, *Publications Astronomical Society of the Pacific*, **27**, 236, 1915).

THE CONTOUR OF THE HYDROGEN ABSORPTION LINES IN NOVA AQUILAE 1918.

By C. T. Elvey.

The large displacements of the absorption lines in a nova spectrum are generally considered to be a true Doppler effect. If we consider the absorption spectrum before the light maximum, that is, before the appearance of the emission spectrum, we might expect the lines to have an unsymmetrical shape as predicted for a pulsating star. In the case of an expansion the maximum of intensity within the line would be displaced towards the violet side of the center of the line.

To test this, objective prism spectrograms of Nova Aquilae 1918 obtained at the Yerkes Observatory on the two days preceding light maximum were examined. The lines appeared to be unsymmetrical but due to the small dispersion the registering microphotometer was unable to give good contours of the lines. On communicating with Professor Stewart of the Dominion Observatory, he very generously sent all the spectrograms of Nova Aquilae that he had of the date June 9, 1918, the day before the appearance of the emission spectrum. Mount Wilson kindly sent the best spectrogram they had on June 8 and on June 9.

Four of the Dominion Observatory spectrograms and the two from Mount Wilson were run through the registering microphotometer, one of the plates both in the direct and reverse directions. Each of the three hydrogen lines, Hβ, Hγ, Hδ, the iron line 4924, and the magnesium line 4481 were found to be unsymmetrical with the maximum intensity on the violet side of the center of the line (these were the only lines intense enough to obtain good contours). Measurements show the red edge of the lines to be at about the normal position of the line, 0.5 A to the red, the point of maximum intensity at a displacement of about 18 A towards the violet, at Hγ, and the violet edge of the line at about 25 A displacement.

The widths of the lines are proportional to the wave-length, the average displacement of the violet edge corresponding to a velocity of about 1800 km/sec. approach. According to the pulsation hypothesis the violet edge of the line would represent the maximum velocity of approach of the expanding shell of gas. In this there may be a possible explanation of the increasing velocities of hydrogen, from —1250 km/sec. on June 8 and 9 to —1700 km/sec. on June 19. As the shell grows larger compared to the star the parts of the shell moving at large angles to the line of sight would not produce absorption and hence the line would be cut off from the red side, and would cause the center of the line to be shifted towards the violet.

A more detailed discussion will be given in a paper on studies of Nova Aquilae 1918 with a registering microphotometer.

TWO K-TYPE SPECTROSCOPIC BINARIES.

By W. E. Harper.

33 Piscium (1900 $\alpha = 0^h\ 00^m.2$, $\delta = -6°\ 16'$) visual magnitude 4.68, and type K0, was announced as a spectroscopic binary in the *Lick Observatory Bulletin* No. 199 from seven plates made during the years 1905 to 1910 inclusive. Three plates were also made at the Cape Observatory in 1917 and all these early observations are well satisfied by the elements of the orbit as determined here. Our plates, made in 1920 and 1926 with single-prism dispersion, yield a probable error of ± 0.8 km/sec. The final elements are:

$$\begin{aligned} P &= 72.93 \text{ days} \\ e &= 0.272 \pm .017 \\ \omega &= 337°.71 \pm 4°.60 \\ \gamma &= -6.56 \pm 0.23 \text{ km/sec.} \\ K &= 16.43 \pm 0.31 \text{ km/sec.} \\ T &= \text{J. D. } 2{,}422{,}530.330 \pm 0.809 \text{ day} \\ a \sin i &= 15{,}856{,}000 \text{ km} \end{aligned}$$

71 Aquilae (1900 $\alpha = 20^h\ 33^m.2$, $\delta = -01°\ 27'$) visual magnitude 4.51, and type K0, was also announced from the Lick Observatory in Volume 3, page 86, of their *Bulletin*. Three plates were made at the Bonn Observatory and three also at the Cape and all these early observations are satisfied by our elements which as before are based on single-prism plates made during the past six years. The probable error in this case is ± 1.0 km/sec.

The final elements are:

$$\begin{aligned} P &= 205.0 \text{ days} \\ e &= 0.128 \pm .042 \\ \omega &= 321°.43 \pm 18°.88 \\ \gamma &= -6.09 \pm 0.26 \text{ km/sec.} \\ K &= 9.78 \pm 0.39 \text{ km/sec.} \\ T &= \text{J. D. } 2{,}422{,}311.55 \pm 10.40 \text{ days} \\ a \sin i &= 27{,}347{,}000 \text{ km} \end{aligned}$$

THE MOTION OF THE PSEUDO-CEPHEIDS.

By F. Henroteau.

In this paper, which is published in extenso in the *Journal of the Royal Astronomical Society of Canada,* the radial velocities of the pseudo-cepheids have been investigated.

When corrected for the motion of the solar system through space, the radial velocities of stars situated in the same region of the sky are of the same order of magnitude. They are all positive, about +40 km, in the region of the celestial sphere opposed to Cygnus, while in the

latter region the mean radial velocity is approximately —30 km. At right angles to the Cygnus region they are nearly zero.

In the Milky Way branch going north from Cygnus are very high negative velocities averaging approximately —40 km, while in the southern branch the presence of two intermingled streams is distinctly visible, one with an average velocity of —3 km, and the other of —38 km.

Added to the two streams of the southern Milky Way branch it may be noticed that the true Cepheids, which are not Antalgols, follow this branch almost exclusively.

THE VARIATION OF LATITUDE AND THE FLUCTUATIONS IN THE MOTION OF THE MOON.

By Walter D. Lambert.

E. W. Brown suggests, as an explanation of the apparently irregular fluctuations in the motion of the moon, that the earth expands or contracts a few inches or a few feet so as to change its moment of inertia. This changes the earth's rate of rotation and hence introduces irregularities into our time system which appear as seeming irregularities in the orbital motion of the moon. It is not necessary for Brown's purposes that this expansion or contraction be uniform over the entire globe, merely that the average amount be adequate. The irregularities in the surface of the earth suggest a non-uniformity of expansion or contraction, especially if the latter occur chiefly near the surface. A properly distributed irregularity in expansion or contraction of the same order of magnitude as the average amount needed by Brown would be sufficient to account for perplexing irregularities in the variation of latitude, also exceedingly convenient, as other explanations are hard to find. No exhaustive study has been made but a preliminary examination indicates that rapid changes in the observed corrections to the moon's tabular places occur at about the same time as puzzling irregularities in the variation of latitude. Caution should be observed, however, since the quantities involved are small and hard to determine, and there has been no adequate study from the geophysical point of view of the suggested expansion and contraction of the earth.

THE TRIGONOMETRIC PARALLAX OF o CETI.

By S. A. Mitchell.

The discovery by Joy that Mira has a companion has explained the large differences in the published values of the trigonometric parallaxes of this interesting star. Two recent determinations have been made with large telescopes, that of the present writer from McCormick photographs giving the parallax $+0''.061 \pm 0''.007$, and that of van Maa-

nen with the 100-inch reflector giving the values —0″.081 ± 0″.036. The light-period of Mira is about 330 days.

In the first series at the McCormick Observatory, the plates in the evening sky were taken when Mira was near maximum, while those in the morning sky were when the variable was near minimum. The rotating sector was used for the evening plates in order to diminish the brightness of the parallax star by about six magnitudes. This completely prevented the companion from leaving any trace whatever on the plates. The morning plates were taken without sector. Under the best conditions of seeing the McCormick plates at minimum give elongated images of Mira, thus showing the companion, which lies in position angle 130°, according to the measures of Aitken.

At minimum light of Mira on plates taken under the above conditions, the companion shifts to the east, or towards increasing right ascension, the center of gravity of the photographic image compared to the position at maximum of light (when the rotating sector cuts out the companion). Hence, if the parallax plates taken in the morning sky are at minimum light (as was the case with the first McCormick series) the parallax will come out with large positive value; while on the other hand, if the minimum takes place in the evening sky, the parallax will be of large negative value (and this was the case with van Maanen's plates).

To eliminate completely the effects of the companion from the parallax, Mira must be bright both in the morning and evening plates so that the companion may be completely cut out by the rotating sector. This was the case in the parallax just completed by the writer from nineteen plates taken between January 1925 and January 1927. For all of the plates Mira was of approximately fifth magnitude, and it was reduced to the tenth magnitude by the rotating sector. The relative parallax is +0″.009 ± 0″.010, which gives the absolute parallax +0″.015.

The relative proper motion in right ascension, $\mu_\alpha \cos\delta$, from the parallax solution is —0″.001, which is exactly the same value obtained from the first series of plates. Dr. van de Kamp has measured two pairs of McCormick plates with an interval of 11 years, using 11 comparison stars of 11th magnitude and he finds the relative proper motion in right ascension +0″.002, and in declination —0″.210. Correcting for parallactic motion of the comparison stars, the motions of Mira become +0″.013 and —0″.217 in right ascension and declination. The values from the catalogue of Boss are —0″.001 and —0″.237, respectively.

SUN-SPOT ACTIVITY IN THE PRESENT CYCLE.

By Seth B. Nicholson and Hazel Marie Losh.

After the last sun-spot minimum in 1923, the spots of the new cycle increased more rapidly than at the similar phase in the past two or three cycles. This great activity so soon after minimum indicated that the

maximum would be high, resembling those of sixty or seventy years ago. Since the beginning of 1926, however, the solar activity has been practically constant and now there is only a little more activity than at the same phase, ten years ago.

If the long period in sun-spot variation, which apparently has been acting in the past, is to repeat itself, the coming cycles should show greater activity than has been experienced during the last four cycles. At present it is impossible to say whether this cycle will be any above normal of the last fifty years.

The maximum, however, will not be reached for another year or two, and the high average latitude of the spots is an indication of an active cycle. The mean distance of the spots from the equator has been about two degrees greater than in the last four cycles. In those the mean latitude was about 14° at maximum.

A comparison of the present cycle with that of 1913-1923 can be made from the following table.

	Number of Groups		Number of Groups Daily		Latitude	
1914-1924	Last	Present	Last	Present	Last	Present
Jan.-Mar.	8	6	0.2	0.3	24°	27°
Apr.-June	19	16	0.8	1.3	25	27
Jul.-Sept.	24	36	1.1	2.1	24	23
Oct.-Dec.	31	26	2.1	1.6	21	23
1915-1925						
Jan.-Mar.	36	46	2.9	2.0	21	23
Apr.-June	41	60	3.2	3.8	20	22
Jul.-Sept.	55	95	3.2	4.9	20	21
Oct.-Dec.	50	98	3.7	6.7	19	20
1916-1926						
Jan.-Mar.	72	88	4.7	6.0	18	20
Apr.-June	86	88	5.6	5.7	16	18
Jul.-Sept.	84	101	4.8	5.5	16	18

A COMPARISON OF CERTAIN REGIONS OF THE MILKY WAY.

By Dean B. McLaughlin.

Two regions of the Milky Way, each covering about 200 square degrees, were selected in Sagittarius and Puppis. Statistics of the stars of the Draper Catalogue were discussed.

The B-stars show the usual galactic and local cluster concentration. In Puppis the G and K stars show decided galactic concentration, which is believed to be partly real, and due to the influence of bright giant stars of the Milky Way structure. Part of the effect is probably due to the incompleteness of the catalogue for the fainter stars.

In Sagittarius there appears to be much less concentration except among the B-stars. F-stars show preference for the region of dark nebulae. The general distribution of stars of the Draper Catalogue and of the Cordoba Durchmusterung shows no effect due to the great star cloud. The greatest star-density occurs west of the cloud.

In Puppis nebulae and open clusters have a wide range from the galactic equator, while they are strongly concentrated to it in the Sagittarius region. They show no relation to the great cloud, except for some stellar planetary nebulae which occur near it. Globular clusters, however, are grouped all about the borders of the cloud and are almost certainly appendages of it.

The great cloud is evidently much more distant than the belt of open clusters and nebulae and the densest belt of the Cordoba DM stars. Counts of stars and a search for very faint variables in the cloud would probably yield important results.

(To be continued.)

TWO HOURS WITH ALVAN CLARK, Sr.

By CHARLES SKEELE PALMER.

The writer is not a professional astronomer,—hardly an amateur; but I am one of those for whom, as my old friend, Dr. Louis Bell, used to say "The stars have a compelling call."

When a lad, working on the old farm in Chicopee Street, walking two miles to the High School, and laboring hard at Latin and Greek, I had the good fortune to be literally caught with an absolute love affair for natural science, and of course astronomy received a fair part of my devotion. So much so that, with the aid of Burritt and Dick (Dear Old Dick), I made a small telescope, and taught myself the stars, so that even now I can place most of them as I remember the trees out in the old apple orchard.

Some years later, as I frequently went from my home in Chicopee, Mass., to North Andover, Mass., where I had charge of the High School, I was carried into Boston on the old Boston and Albany R. R. and of course any one with natural interest would have to note the towering telescope tube that hung right across the Charles river, over in Cambridge. Of course I made up my mind to visit that sacred spot just as soon as opportunity should offer; which it did, one bright day in October.

As I wended my way down the street whereon I supposed I would naturally find the Clark home, I had to make frequent inquiries as to the whereabouts of that noted astronomical artisan, Alvan Clark, but nobody in all that region knew anything about such a man.

One old German store-keeper, who said he had been there for years, insisted that I was on a false scent, and that there was no astronomer at the foot of that street, where shortly after I found the object of my quest. That was back in about '82 or '83 and I reflected that the old

adage concerning a prophet in his own country was about true in Massachusetts.

Arriving at the shrine of telescope making in America, I was sent from the front door to the rear of the grounds, where I found the shop. Therein I entered somewhat timidly, for I was no professional, only a science-crazy student, but at least I would have a chance to see something before I was kicked out,—as I very properly deserved, if I was to be in the way. Soon, as I entered, a pleasant middle-aged man, who turned out to be Alvan, Jr., asked me what I wanted, and, on my boldly asking for his father, said that he was busy with some visitors who had come to close a contract with his firm for a large instrument. All right, but meanwhile there was much to see that even I could understand, and much more that I frankly did not. But I noted the quiet, easy bearing of the son, and the nervous, almost saint-vitus-dance style of the elder Clark, since, as he afterwards told me that day, he was then about 82 years old.

It has always been my impression that Mr. Clark had gotten that shaking-palsy habit from his standing and polishing the lenses with the tips of his fingers and thumbs, in the natural forward-and-back motion; for I distinctly recall that he called my attention to the fact that there is no polishing leather so soft for the final finish as the tips of the fingers and thumbs, and I think that he must have said something about the shaking habit so contracted,—at least that was my impression.

I was invited to wander about for myself. I was not told not to touch things, but naturally I did not dare to violate such sacred grounds. However, I did look a whole lot, on the main floor, and in an ell or cellar, I have forgotten which. All were busy with work. Both the Elder and the Younger Clark, with several assistant workmen, were doing this and that to several lenses, on what looked like lap-wheels or polishing stools. All was quiet, but much was doing. After about an hour, Mr. Alvan Clark, Senior, came to me and asked what he could do for me; and I frankly told him that my intrusion, though perhaps insolent, was based, however, on a real interest, for I had heard of him all my life, and wanted to see him at work. And then the unexpected happened, as that wonderful old gentleman took me right in for just what I was, a most respectful and most interested ignoramus; and what a time we had together! It was as though he were my own grandfather, as he first showed me all the details of his work that I might be expected to understand, from a nice 10 or 15-inch lens that was being finished, to the great 36-inch crown glass of what was later to be the Lick Telescope at Mt. Hamilton. They were then waiting for the completion of the 36-inch flint to match it.

After that Mr. Clark took me into the garden and showed me the trial-tube for all new lenses. That one was never used up to his prophetic limit, for he told me that it would carry a 50-inch lens.

Then we went to the garden proper, where we talked of men and

books, and people. Mr. Clark was a member of an Emerson Club that met in Boston every month, and he told me of men and minds there. He filled our straw hats with grapes, and we ate like boys, talking 333 words to the minute,—for Alvan Clark was thoroughly human. I may not remember all that he said, but there was one remark that I have often quoted. It was just before I thanked him heartily, and said good-bye, that he looked up and exploded with (he was talking of those discussions at that Boston Club, and we both were eating fast all the while) "Some people say that there isn't any God,—Nonsense,—of course there is." Dear Old Saint, of course there is a God, even if you do say it on a mild October morning, while that same God is filling your mouth with delicious grapes, and in the presence of one of his saints. Well, I never saw Alvan Clark in the flesh again; but his enthusiasm remained with me and has been an inspiration many times, as I went away and reflected on his technique, his human-nature, and his commonsense goodness; and when we are despondent over the petty ambition of some men—we are counterbalanced by that marvelous and reverent creative genius of an Alvan Clark.

4333 Dakota Street, Oakland Station, Pittsburgh, Pa.
December 3, 1926.

TEMPERATURE MEASUREMENTS ON THE PLANET MARS, 1926.*

By W. W. COBLENTZ.

I. Introduction.

Last week occurred one of the few clear sunsets that we have had for some time this fall. On the eastern horizon was the rising full moon and near by was a bright light, not unlike a street lamp, only redder. It was the planet Mars. The dark markings on the moon are always impressive as viewed with the unaided eye, and more so when viewed through a telescope. If we except the actual configuration of these dark markings there is something strikingly similar and certainly very impressive in the appearance of the nearby full moon, as viewed through the dimly illuminated sky at sunset, but without a telescope, and of the planet Mars as viewed in a long focus telescope. The fading daylight seems to remove the contrast and the harshness of the lunar markings, and it seems to impart a blueness to the coloring of the dark areas as viewed without a telescope, somewhat similar to the blueness of the dark markings on Mars as viewed through a telescope. Add to

*Extracts from an address before the Scientific Staff of the Bureau of Standards, Nov. 26, 1926; based upon measurements obtained with Mr. C. O. Lampland at the Lowell Observatory. Published by permission of the Director of the Bureau of Standards.

this the pearly whiteness of the south polar cap, pin-head in size, which glowed like the frosted globe of an incandescent lamp, and an occasional white cloud, which, because of its elevation on the east or west limb, produces a sort of stereoscopic or plastic effect on the disk,—this is a rather crude word-picture of the appearance of the planet Mars, as viewed casually through a large refractor.

Mars is an interesting heat engine in the form of a sphere rotating on its axis. As the snow is melted at one pole the water is precipitated and congealed at the opposite pole. With noonday temperatures up to 30° C, or perhaps even higher, there is not much chance for water to remain in the liquid state at noonday on the equatorial zone of Mars.

The temperature and the radiation of the surface of Mars are intimately connected with the meteorology of that planet. There are no oceans on Mars, and climatic conditions are no doubt simpler than our own. When it is summer on one hemisphere, and the sun's rays are melting the polar snows, what little water vapor exists is traveling (probably by diffusion and by strong winds) to the opposite hemisphere to be deposited as snow at that pole, where the temperature is the lowest. This has been observed for years. During the two equinoctial periods the surface is more obscured by clouds or mist.

The dark areas are thought, by Pickering, to be moistened soil (rain tracks) and vegetation resulting from the deposition of some of the planetary moisture in its transit from one pole to the other. Evidently there cannot be much moisture, otherwise the dark areas would be cooled by evaporation instead of being highly heated, as observed.

The measurement of the actual temperature of the surface of Mars does not seem so impressive. To me the most impressive thing is the possibility of observing the variations of the surface temperature with the season. On this earth we find that the summer hemisphere is much warmer than the winter; and when it is summer here in Washington, it is winter on the South American continent. The hottest time is not at the summer solstice but a month or so later. By that time the north polar region is at its highest temperature. Furthermore it is cooler in the morning than in the afternoon, and this condition is affected by clouds.

Now what do we observe on Mars? Piecing together the data for the oppositions of 1924 and 1926, all are in agreement in indicating that the southern hemisphere (the summer hemisphere at these two oppositions) of Mars is warmer than the northern hemisphere. The surface temperature rises as summer advances. It is hottest in the summer hemisphere, at least in the temperate and frigid zones of Mars, not at the time of the Martian solstice, but a month or so later, because of the accumulation of heat, as observed on this earth.

Furthermore, the morning side (sunrise) is cooler than the afternoon, except when there are afternoon clouds to obscure the surface and prevent the (surface) radiation from escaping. Under these con-

ditions the morning side of the planet has been observed hotter than the cloud covered sunset edge; but less than an hour later conditions were just the reverse. Observations on the escape of nocturnal radiation from this earth show that but little cloudiness is required to prevent the escape of radiation from the surface through the atmosphere into space. Similarly, though to a less marked degree, clouds on Mars prevent the escape of heat rays from the surface into space. This is indicated by the high transmission of radiation through the water cell and other screens used, whereas, on other nights, these same locations on the planetary surface of Mars give the normal (low) water cell transmissions, *i.e.* the normal radiation and normal surface temperature.

This mapping of hot and cold spots, indicating the meteorological conditions on the surface seems more impressive to me than the actual temperature determinations. It means that the time has come for the active co-operation of photographic, visual, and radiometric methods of observation to determine when these cold areas are caused by clouds and when they are due to the low temperature radiation from the bright areas, which are cooler than the dark areas on the planetary surface.

It is strange how incorrect reports will persist in the face of published facts. For example, in the fall of 1924, a semipopular news item, which is still quoted by news writers, appeared stating that the two observatories engaged in the measurement of planetary radiation differed in their estimates of temperatures on Mars. As I pointed out in *Science* there was no real disagreement. What happened was that the Mt. Wilson data were first published as "black body" temperatures, while the Lowell Observatory estimates were in "true temperatures" which are 10 to 12° C higher. Since then the former estimates[1] have been increased in round numbers to 300° absolute, or 27° C. While this was a generous estimate, for the data of 1924, it fits in well with our estimates based on this year's observations.

My interest in the opposition of Mars this year was to obtain one more check on the temperature estimates, especially on the east and west limbs of Mars. For, about 13 years will elapse before there will be another equally favorable opportunity for radiometric measurements, and the present series was merely the culmination of the preliminary measurements begun during the Martian opposition of 1922. For the purpose of completing this work, two of the best vacuum containers, each receptacle having two thermocouples, and the Thompson galvanometer were left in place in the Lowell Observatory, after the completion of the series of measurements in September, 1924, and the observations were continued throughout the subsequent three months by Mr. C. O. Lampland.[2] All these data should prove useful when published.

[1] Ann. Report of Director, Mt. Wilson Obs., Carnegie Inst. of Washington, Yearbook No. 24, p. 104, 1925.

[2] Lampland, Pop. Astron., Vol. 34, p. 620, 1926.

Arriving at the Lowell Observatory late in September of this year I found that favorable weather had enabled Mr. Lampland to obtain an extensive series of measurements on Mars, especially through the month of September. These data, combined with what we observed in collaboration, and what he hopes to obtain subsequently, using the same apparatus, should form an interesting record of climatic conditions extending over a much longer period than previously observed.

II. Instrumental Equipment and Methods of Observations.

After four years of good service the thermocouples in vacuum container No. 11 had but recently ceased to function. A new set of thermocouples was therefore made, and a new rock salt window was provided, forming mounting called No. 15 used in the present work. The diameters of the receivers of one of these thermocouples were only 0.12 and 0.14 mm, respectively, (the smallest yet tried) and at the 80-foot focus the smallest intercepted only 0.05 of the diameter of the planetary image.

In addition to these two mountings, Nos. 11 and 12, which had been left at Flagstaff, I took with me vacuum container No. 14 (the old mounting No. 13 of 1924) with a new rock salt window and with new thermocouples having receivers 0.22 mm in diameter; also the old mounting, No. 7, containing the two thermocouples used in 1914, which are still in good condition in spite of one trip to California and four trips to Arizona, totaling over 26,000 miles.

A new suspension was placed in the ironclad Thompson galvanometer. It was constructed so as to have higher air damping, and differed but little in sensitivity from the suspension used in 1924.

The telescope used was the Lowell reflector having a maximum diameter of 42 inches, though sometimes reduced to 40 inches. The auxiliary mirrors gave focal lengths of 18, 53, and 80 feet, and at opposition gave planetary images of Mars 0.6, 1.6, and 2.4 mm in diameter. Thermocouple No. 14-1L, with a receiver 0.22 mm in diameter, when used at the 80-foot focus intercepted 0.1 of the diameter, or 0.01 of the area of the planetary image. Thermocouple No. 15-1L having a diameter of 0.12 mm and as used at the 53-foot focus intercepted only 0.075 of the diameter of the planetary image.

At times one can see the image of Mars surrounded with a brilliant narrow band of "limb-light" which comes from the Martian atmosphere, and which probably emits but little if any radiation. In using these extremely small receivers near the limb uncertainties may arise in the interpretation of the measurements owing to this "limb-light," and consequently the deduced temperatures may perhaps be too low.

As in previous investigations on Mars the radiation was separated into spectral components by means of screens of water, quartz, glass, and flourite, which enables one to determine the amount of radiation in

the spectral regions extending from 0.3 to 1.4μ, 1.4 to 4.1μ, 4.1 to 8μ, 8 to 12.5μ, and 12.5 to 15μ.

Two screens of glass 0.085 and 0.16 mm in thickness were tried this year, but they did not disclose any difference in the radiation at 6 to 8μ greater than the errors of observation.

The selection of the quartz and the glass screens in 1924 was fortunate. For, as anticipated, it enables one to study the variation in transparency of the atmosphere at 4 to 8μ with variation in humidity and in air mass. There are some indications that in spite of the large errors of observation it may be a more reliable test of the amount of water vapor in the atmosphere than is the test made with a wet- and a dry-bulb thermometer which, at best, gives an indication of the vapor pressure of its immediate surroundings.

In this year's measurements all the screens showed a lower transmission, that is to say, a greater amount of infra-red planetary radiation than observed in 1924. This is owing no doubt to the much higher altitude of Mars, and consequently the decreased air mass and, hence, the absorption of infra-red radiation. This increased transparency is especially noticeable in the spectral region of 4.1 to 8μ as disclosed by the observations through the quartz and glass screens.

In the measurements of 1924 the thermocouple was horizontal and the method of observation consisted in making all the measurements upon one spot, using all the screens, before selecting a new region. When using the U-shaped thermocouple and setting the left and the right-hand receiver upon the same region on the planetary image any unequal heating of the intervening wire would be eliminated. When using the straight-wire thermocouple horizontally the thermojunction receiver and intervening wire were exposed symmetrically on the north and south polar regions. But in the settings on the east and the west limbs a little more of the intervening wire might be exposed to radiation in one case than in the other. Although the wire had been tested for homogeneity and although the high reflecting power prevented heating by absorbing infra-red rays (also the measurements with the U-shaped thermocouple showed no difference) in this year's work the measurements on the east and on the west limb were made with the thermocouple in both the vertical and in the horizontal position. No difference was observed in the results.

Moreover, to save time, and to avoid possible slight differences in focus when using the water cell, in this year's work a series of measurements was made alternately on the N and S poles (or on the E and W limbs) without the water cell; then a series with the cell interposed; then another series without the cell. This required the observation of 24 to 30 galvanometer deflections. In the crucial tests on the east and west limbs, during one evening (Oct. 27) two such sets of measurements, of 56 and 66 galvanometer readings, were made. This should

give a better average than a single momentary record impressed upon a photographic plate.

In view of the fact that some astronomers still cannot understand why we should obtain such low temperatures on the poles and limbs of Mars, before discussing the observational data, it is relevant to emphasize once more the function of these screens and the interpretation of the measurements obtained with them. The apparent temperature of a certain region on Mars may be estimated from the amount of radiation transmitted through the water cell. If the transmission is low it means that the infra-red radiation is high, owing to a high surface temperature. But if the transmission is high the water cell is not a sufficient means to determine whether the observed high value is owing to a low surface temperature or owing to an overhanging cloud or mist of water vapor which prevents the escape of the planetary radiation from the surface. Here visual and photographic means must be employed to supplement the radiometric measurements which, in the case of the presence of clouds, do not refer to the surface but give the temperature of an effective radiating layer situated at some distance above the solid surface.

For example, the disappearing south polar cap, which is evidently of melting snow and ice, indicates that the temperature is 0° C, whereas an interpretation of the high water-cell transmissions indicates a temperature down to perhaps —60° C. This may be true of the north polar region where it is winter, but it does not apply to the melting south polar cap.

Instead of thinking of this difference in temperature at the south pole as an incongruity, it is a pretty good demonstration of the presence of an atmosphere containing water vapor which prevents the escape of planetary radiation.

Similar considerations apply to the measurements on the east and west limbs; after having a good view of the brilliant ring of light on the limbs, relative to the size of the receivers used, one needs but little imagination to realize that part of high water-cell transmission and the consequent low temperature may perhaps be owing to the setting of the thermocouple out, over the edge of the planet, upon the atmosphere, instead of the inner tangent, as was intended.

In addition to this limb-light is the frequent visible presence of clouds on the limbs. Moreover, with evaporation of water at one pole and condensation at the opposite pole, and with a high noonday temperature, it is perhaps conceivable that there is a circulation of moist air along the twilight zones. In this case the escape of planetary radiation would be prevented and low apparent temperatures would be observed along the limbs of the planet. There is nothing novel in such an assumption of the presence of water vapor along the limbs of the planet. It is a frequent observation when a large white cloud overhangs the dark area, called Syrtis, on the east limb, that this overhanging vapor dissi-

pates or disappears as the Syrtis rotates towards the center (noonday) of the disk. Evidently the night temperatures cannot be as low as indicated, otherwise there would be frost on the east limb and the polar caps would be unsymmetrical as the frost area rotates into view and melts before sunset.

During the present opposition the south pole of Mars is tilted towards us and the north pole is tilted away from us, so that when we set the thermocouple receiver on the north edge of the planetary image we are not placing it upon the north pole (winter) but upon a region pretty far down into the north-temperate zone. This explains why such high temperatures were observed when setting upon a point midway between the center of the brightly illuminated disk and the northern edge which is some distance from the pole of the planet.

III. Radiometric Measurements of Selected Regions on Mars.

In addition to the repetition and verification of previous measurements on the limbs and the poles of the planet, the outstanding results of this year's work are the developments from the measurements of radiation from the surface through clouds on Mars. The radiometric measurements recorded in this paper were made on 15 nights during October and the first week in November. Hence, they cover a period when there was a bright phase on the east limb, (which was irradiated an hour or more before Martian sunrise), through perigee (Oct. 28) when the planetary image was a maximum, and when the disk was completely irradiated, during the first week in November. This year the Martian solar solstice on the southern hemisphere occurred August 5, and hence, the south polar region had probably attained its maximum temperature by November.

Center of the Disk. Owing to the manner in which the south pole was tilted toward the earth at this time, in setting the thermocouple receiver on the center of illuminated planetary image, the radiometric measurements were made on a region somewhat south of the Martian equator.

As observed previously the bright areas are cooler than the dark areas. This was established in two ways: (1) by measuring the radiation from a dark area, for example, Mare Cimmerium, and the adjacent bright region when they were on the central meridian and on the center of the disk, and (2) by measurements of bright regions and dark regions (*e.g.* Syrtis Major) as they appeared successively on the center of the disk. The latter could not be observed simultaneously but there is sufficient evidence, obtained during two oppositions, to support the conclusion that the bright areas are cooler than the dark areas.

Evidently the thin clouds, sometimes observed over the dark Syrtis Major, are dissipated under a noonday sun, thus giving the observed low water-cell transmissions. Nevertheless, one wonders whether sometimes such cloudiness persists during the Martian night and assists in conserving the heat and maintaining the observed high temperature. In

that case the noonday temperature of the Syrtis might be higher than usual, after clouds have been observed over it at Martian sunrise, because it had not cooled so much during the Martian night.

North and South Polar Regions. Measurements were made on the north and south polar regions and at points half-way between the poles and the center of the illuminated planetary image.

A conspicuous feature of this year's measurements is the much lower water-cell transmission than observed on the polar regions of Mars in 1924. One reason for this is that the measurement on the northern hemisphere is not so close to the pole while on the south pole it is a Martian month after solstice instead of a month before, as in previous measurements.

Sometimes the measurements at the mid point (observations of Nov. 3) indicate a higher W.C.Tr. = 41.7 p.c. (a lower temperature) in the south-temperate zone than at the center of the disk. Again, on some other date (Oct. 15) the water-cell transmission of the radiation emanating from this mid point seemed unusually high indicating the presence of clouds.

The temperature of the north-temperate zone was higher than observed in 1924, and, as a general observation, the differences in temperature between the center of the disk and the poles were not so great as observed at the previous opposition.

On Nov. 5 the temperature (W.C.Tr. = 30.7 and 30.9 p.c.) of the south-temperate zone remained constant while the temperature of the point midway between the north pole and the center increased (W.C.Tr. dropped from 35.5 to 28.1 p.c.) as the dark Syrtis rotated on the meridian and the latter was hotter than the summer hemisphere. This same inversion occurred on the midpoint of the west limb and the center of the disk.

In addition to the measurements across the disk in the north-south and the east-west direction one night was devoted to measurements across the disk in the direction from N 45° E to S 45° W, and from N 45° W to S 45° E. These measurements are interesting in showing an unsymmertical temperature distribution over the disk, especially in the south west quadrant, which was darkened by the presence of the Solis Lacus. A warm area in the south-temperate zone was noted on Nov. 1.

In a cursory examination warm and cold areas were located on the apparently uniformly illuminated disk, showing that the thermocouple can detect clouds or bright areas not visible to the eye.

East and West Limbs of Mars. One important reason for undertaking this year's observations was to obtain further temperature measurements on the east and the west limbs of the planet Mars. Our previous measurements showed that the east limb (the sunrise side) of Mars was cooler than the west limb, or sunset side of the planet. Pettit and

Nicholson[3] call attention to the fact that this is in disagreement with their observations. Just why this point is emphasized when, contrary to our observations, their drift curves do not show (at least not very conspicuously) differences in radiation, and hence differences in temperature of the bright and dark areas, is not clear; except that it raises the question of the amount of water vapor and the extent of the atmosphere on Mars.

As previously noted, they used a receiver 0.2 mm wide and 0.3 mm long on a planetary image 1.6 mm in diameter. The receiver, therefore, intercepted 1/8 of the diameter in the east-west direction, and 1/5 of the diameter in the north-south direction. In other words the receiver extended pretty well into the south-temperate zone, when setting on the center of the disk image of Mars. The axis of Mars was tilted appreciably (38° in 1926) with respect to the meridian. Hence, in taking drift curves in right ascension, the thermocouple did not pass directly from east to west across the disk, but passed somewhat from N.E. to S.W. Hence, on the west limb it might be in a much cooler zone than on the east limb, and this might counteract the effect of a higher temperature on the sunset side of the planet. It is not explained how the factors were obtained to correct for the orientation of the axis of the planet relative to the line of drift across the disk, and for the integrating effect of the long receiver used.

It is hardly to be expected that drift curves across the planetary image, taken with a recording device that intercepts but once a certain part of the planetary image, for only a few seconds, will necessarily be in agreement with the average of a series of measurements in which this same part of the planetary image is held under observation for 5 to 10 minutes, during which time one to two dozen (in one case 56 and 66) settings of the receiver were made and the galvanometer deflections recorded, instead of only a single reading. However, assuming that the two methods give comparable results, owing to the presence of dark areas, cloudiness, and water vapor, as this year's measurements clearly show, it is a matter of chance as to what temperature conditions will be observed on the limbs of the planet. This statement may be a little depressing to those who argue for a low water vapor condition on Mars. However, their conclusions are based on spectroscopic tests which refer to the whole, (especially to the center), of the disk instead of some isolated region near the edge. No doubt when astronomers become more familiar with the thermocouple, its usefulness in this field will receive due consideration. After seeing the white cloud-patches and bright areas it is not difficult to believe that the unusual radiometric results are caused by the climatic condition on Mars.

This year's measurements show various temperature conditions on the limbs (and for that matter on various other parts) of the planetary

[3] Pettit and Nicholson, Pop. Astron., Vol. 32, p. 608; 1924.

disk. As a general rule we have found the forenoon side of the planet cooler than the afternoon side. But there were exceptions, such as for example on October 10; at 1 A.M. the east limb was slightly cooler than the west limb. Two hours later, when the dark area (Syrtis Major) was rotating into view, after an hour's exposure to the sun, the east limb was hotter than the west limb. Also at Martian sunset, (11 P.M., Oct. 27), with a white cloud overhanging the disappearing Syrtis under an evening sun, the temperature of the west limb was lower than the east limb. Two hours later (1 A.M., Oct. 28) when the east limb was unusually bright (clouds, as had been predicted by Mr. E. C. Slipher from his unpublished observations of the previous night) the morning temperature was apparently considerably lower than the west limb. The term "apparently" is used because we were evidently measuring the radiation from a source somewhere above the surface instead of the actual surface of Mars. One night (Oct. 11) when the east limb appeared dark it had the same temperature as the west limb; and on another date (1 A.M., Nov. 1) when the Syrtis was near the west limb the temperature was higher than on the center of the disk. On Nov. 4, with excellent seeing and the dark Syrtis on the central meridian, and the east and west limbs apparently of the same brightness, the west limb was the warmer. This is based on 3 sets of observations, totaling 56 reading during about 25 minutes. Two hours later (Nov. 5) a set of 66 readings extending over a period of 20 minutes showed the east limb cooler than the west limb although it then seemed the darker in appearance.

From the foregoing it appears that there is no real disagreement in the Mt. Wilson and the Lowell observations of 1924. But the conclusions arrived at will be a matter of chance and they will be uncertain unless there is good seeing and unless the measurements can be extended over a long period.

The numerous drawings by various observers show that it is quite difficult to find two regions having the same physical conditions (absorptivity), one on the east limb, the other on the west limb, and the two in the same latitude. It requires great familiarity with the surface features of this planet in order to make the selections, especially when there is poor seeing. The writer was, therefore, singularly fortunate in being associated with observers who have had many years of experience with the varying features of Mars.

In spite of these difficulties of surface brightness and clouds, the prolonged series of measurements of 1924 and of 1926, made on the limbs, and on points half-way between the limbs and the center of the planetary image, as a general rule, indicate lower temperatures on the east limb than on the west limb of Mars. This is apparent in all our measurements using the different focal lengths, that is, wide and narrow integrations over the planetary surface.

Now, that seems to be about all there is to it, as far as the physicist

is concerned. "Of course," he says, "what else would you expect of a rapidly rotating planet having an atmosphere and water vapor?" "What would prevent the unilluminated surface of Mars from cooling still more during the 12 hours between sunset and sunrise?" "Hence, how can the morning tempertaure be the same as the evening temperature, especially when there is a possibility of the presence of clouds?"

On the other hand the astronomer is not so easily satisfied. To admit a temperature difference on the limbs of Mars is to affirm the age-old question of the presence of an absorbing and heat-retaining atmosphere, and perhaps a little more water vapor than the spectroscope has yet shown. But the possibilities of the spectroscope may perhaps be overestimated on this particular question; and, anyway, it has given only average values for the whole disk, whereas the above discussion relates to the limbs and poles[4] of the planet. When we have spectroscopic data on the limbs and on the clouds, we will be in a better position to judge the matter. In this connection, it would be interesting to obtain some spectrograms of the light reflected by terrestrial clouds.

Of course, the presence of some water vapor and an atmosphere is admitted; and even though the radiometric drift curves may not show temperature differences on the east and west limbs, their form seems to deviate sufficiently from the true cosine curve to permit the interpretation that the temperatures at sunrise and at sunset are lower than would be the case if the planet had no atmosphere whatever to reduce the incident light.[5]

In concluding this discussion it is relevant to add that no doubt the time will come when a useful application can be made of these data regarding clouds and the temperature differences of bright and dark areas in arriving at some reliable estimate of the night temperature on Mars. From a comparison of the measurements on the mid-points and the east and west limbs of Mars on Oct. 28, it appears that the clouds on the west limb were thicker or denser than on the east limb.

IV. Planetary Temperatures.

The temperatures of the various regions measured may be estimated by several of the methods previously employed.[6] First, it is to be noted that the water-cell transmissions are low as a result of the presence of planetary radiation owing to the decreased air mass ($M = 1$) as compared with an air mass of 1.5 to 2 as obtained in 1924.

On the other hand, the ratio (A : B) of the spectral components of

[4] Very, Lowell Observatory Bull. No. 65, found that the spectrograms, taken by V. M. Slipher in 1914, showed a greater amount of water vapor over the polar region than over the equator.

[5] Ann. Report of Director of Mt. Wilson Obs., Carnegie Inst. of Washington, Yearbook No. 24, p. 104; 1925.

[6] Coblentz, B. S. Sci. Papers (No. 512) 20, p. 372, 1925; Popular Astron., 33, p. 310, 1925. Coblentz and Lampland, Jour. Franklin Inst. 199, p. 785; 200, p. 103, 1925.

the planetary radiation at 8 to 12.5μ and 12.5 to 15μ, respectively, as observed with the glass and the fluorite screens is unusually large. This large ratio would result, at least partly, from the decreased air mass and, hence, the decreased absorption of water vapor, which undergoes a greater variation at 7 to 9μ than at 12 to 15μ.

Now, all these calculations refer to the transmission through the terrestrial atmosphere. Nothing is said about the selective spectral depletion of the planetary radiation as it emanates from the surface and passes out through the atmosphere of Mars.

It is generally agreed that the water vapor is low on Mars. But nothing is known of the amount of ozone and carbon dioxide which are known to exert a great absorption—especially CO_2 which has a great absorption for wave-lengths greater than 14μ. Fowle's researches indicate that 1/40 part of the amount of CO_2 actually present in the vertical terrestrial atmospheric column produces the maximum possible absorption.

On this basis the transmission of planetary radiation through the Martian atmosphere at 7 to 9μ would be greatly increased relative to the value at 12 to 14μ (CO_2 absorption). This might escape detection in 1924 because of the larger air-mass and, hence, the greater terrestrial absorption at 7 to 9μ relative to the absorption at 12 to 14μ, which varies but little with air mass. This should increase the calculated values of the ratios A : B, and be more nearly comparable with the observed values. The writer has made such calculations on the basis of 0.5 cm precipitable water in this terrestrial atmosphere and 0.01 cm in the Martian atmosphere; but using the same ozone and CO_2 absorption in both atmospheres (atmosphere transmission data from Smithsonian Phys. Tables). This increases the calculated value of the ratio A : B. But there is still an outstanding selective emission, giving an abnormally high observed value (ratio) of the spectral component radiation at 8 to 12.5μ (=A) relative to the value at 12.5 to 15μ (=B). This means that either the temperatures on Mars are higher than seems possible from other considerations, or there is an unusual selective absorption and emission on Mars that is not accounted for in the calculations.

Hence, pending a further study of the atmospheric transmission coefficients and a further investigation of the transmission screens, and keeping in mind that, owing to cloudy conditions over the Martian surface, our temperature values along the edge, especially along the east and west limbs of the planet are too low, the following tentative estimates of planetary surface temperatures are given:[7] as viewed on the central meridian, the south polar region —10° to +10° C; south temperate zone 20° to 25° C (clouds —10° C); center of disc 20° to 30° C; north temperate zone 0° to 20° C; north polar region —25° to —40° C; east limb (after being irradiated for an hour) —20°C, clouded —35°C,

[7] Coblentz and Lampland, Amer. Astronom. Soc., and Amer. Phys. Soc., Meetings of Dec. 28 to 30, 1926; Phys. Rev., 29, p. 372; 1927.

no phase —25° C; west limb (terminator) 0° C, clouded —30° C, no phase —10° C.

Washington, D. C., November 27, 1926.

THE ASTRONOMICAL FRATERNITY OF THE WORLD.

By DAVID B. PICKERING.

Part I.

To the amateur astronomer, making his maiden pilgrimage to Europe, the genial hospitality and sympathetic interest of Old World astronomers add a richness to his experiences that the conventional tourist cannot enjoy. Let no one who loves the stars fail to visit those good people while over seas, for the pleasure is reciprocal. The fraternal feeling among those earnest searchers for knowledge and truth is strong and universal.

It was on an evening, early in March, 1926, when my wife and I stepped from the Florentine colorfulness of the salons of the new Italian ship *Conta Biancamano,* on to the broad dock at Naples. For miles along the gentle curve of the sheltered bay, the lights from the shore drive and water-front hotels twinkled a welcome through the darkness. Somewhere beyond the heights above the city we knew that that menacing monster, Vesuvius, was lazily smoking—as we had glimpsed him on the horizon, far across the Tyrrhenian sea, before darkness had fallen like a dropped veil over the world.

Somewhat later we stood on the balcony of our bedroom above the Via Partenope, listening to an aria from some old opera as it floated upward from singers in the street below. From somewhere came the harsh, intruding bray of a burro . . .

It was spring—we were in Italy—as excited as children, we inexperienced travelers felt a little like dream folk in a dream world.

Our minds were still full of the interesting novelty of ship life: the navigators taking the noon sights; the good Captain, as genial as he was huge, with whom we made good friends, and whose interest in things astronomical led to many pleasant and profitable visits to his snug cabin below the bridge; the operation of the Sperry gyroscope—keeping the ship on its course while the navigators idled watchfully by; the always marvelous wireless equipment—incessantly snapping out its informative signals. All these formed highlights for the background of our voyage.

In the days following we were to be fascinated with hosts of strange sights. The strange manners and customs of a strange people, who seemed always kindly and cheerful—always smiling and singing.

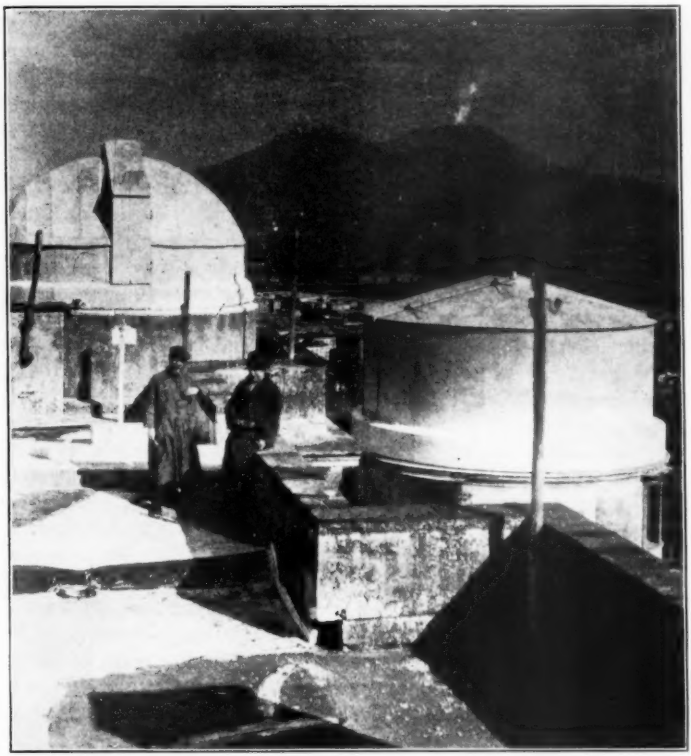
Impressions crowded upon us: The diamond shaped lava blocks with which the streets were paved; the oddly mated teams of Quixotic horses and diminutive donkeys, with the high topped towers of their harnesses; the porchless houses of masonry, whose entrances were simple archways leading into courtyards; soups in which floated the tentacles of young octopi; the narrow streets of the ill-smelling markets where our carriage wheels just missed the walls of the opposing buildings; the absence of sidewalks; the absence of all traffic regulation; the seeming absence of fire apparatus—in a city where wooden structures seem quite absent; spaghetti hanging yellow and wet on frames along the street edge, to bleach and dry in the sun—and among the flies; and back of the bay the terraces of hills, dotted with gray dwellings, rising to their semicircular background of mountains. And to this background must be added the towering majesty and beauty of Vesuvius—always lazily smoking—terrifically threatening—a living giant, never wholly quiescent.

Early one afternoon we boarded a tram bound for the Royal Observatory. Situated within the grounds of what was once a royal preserve, high among the hills to the north of Naples, it commands a glorious view of the city and its bay. The suburb in which it lies, is called, appropriately, Capodimonte, or Head of the Mountain. Our groaning car slowly climbed the turning and twisting roadway which rose always higher and higher between vine covered walls, over which we glimpsed white villas set amid flowering gardens. Everywhere were vine and cacti and the pale green of olive trees, while row on row against the sky were silhouetted the spread branches of the picturesque pania.

A ten minute walk from the terminal of the line brought us to the high, rough outer walls of the Observatory grounds, within which we followed ever curving paths which seemed more like tunnels because of the height and continuity of their vine covered walled sides, the tops of which were splashed with clusters of red blossoms. These led under arches, across courts and up winding steps to a wide plaza, whereon faced the massive stone structure of the Observatory building. An air of quiet dignity pervaded the somewhat unkempt surroundings of this classic edifice. The still somberness of the deserted grounds being in strange contrast to the crowded movement and color we had so recently left.

As the great portal swung open, we saw standing before us, a little man in a gray smock. There were twinkling eyes above the Van Dyke beard and a broad smile of welcome for the unheralded strangers without. It was Bemporad. Years ago, the American Association of Variable Star Observers had been happy to elect this good man to honorary membership in its Society, and upon learning our identity, the pleasure he evinced at meeting a member of that body was most evident. German proved to be the only tongue we had in common, and how thankful I

was for even so slight an acquaintance with it as I possessed. Eagerly he welcomed us, and as eagerly began showing us about. As we passed from one high-ceilinged room to another—all austere in their cold severity—we noticed books, pamphlets and records, exceeding the capacity of the shelves, piled high on tables and chairs. Everywhere was roominess without order—evidence of activity without workers—over all an air of recent desertion, as if the staff had suddenly left for a



On the Roof of the Royal Observatory, Capodimonte.

holiday. But we very soon learned that the "Staff" of the Royal Observatory consisted of the Director, Azegito Bemporad, and his cousin, Guilio Bemporad. Besides these, it is true, there were a stout and elderly woman puttering about the rooms, whom we took to be a caretaker, and the plodding old gardener who had directed us to the portal. Thus two astronomers were "carrying on" in this massive workshop, which seemed adequate to house comfortably, a staff of thirty or forty workers.

We were shown two transit instruments and a meridian circle—all of German make—which at the time were being used by Signor Guilio, who later presented me with a copy of his published work on the variation of latitude. Two of these instruments are supported by columns of black Egyptian marble, and the Director remarked: "Pillars from Egypt, instrument from Germany, observer from Italy." A seven-inch refractor of English make is their largest instrument and in conjunction with this is used a splendid Potsdam photometer—especially in the observation of variables.

We mounted the stone steps that led to the roof, and stood among the domes looking down over Naples, lazing at our feet by its blue arc of bay. Then our eyes crept eastward, across the miles of minature white dwellings of Old Naples that crept up and up over the low hills to the very foot of the smouldering Vesuvius.

Seated at last before the negative frames in the Director's workroom, we kept our caps on our heads, for even here in Sunny Southern Italy it was raw and chill in March and there was no thought of attempting to heat the great rooms of the Observatory. Here Bemporad told us of his life and work—always with that appealing smile backed by a touch of sadness, but frank, kind and utterly sincere. We learned that the Royal Observatory, as a National institution, receives its support from the Government; but the funds forthcoming are altogether too meagre to support a staff or permit the publication of results except at very rare intervals. Several records have come from the press at odd times, between the years 1907 and 1925, but none during the war period.

The work of the Director at present is wholly with the micrometer—determining positions from photographic negatives. His values being derived from data furnished by Harvard Photometry and Harvard Annals. For such little observation of Variables, as may be done, Father Hagen's charts fulfill their splendid purpose.

From the astronomical classes of the University of Naples comes never a student, prompted by interest or curiosity, to inspect the Royal Observatory. A visitor's register would be a useless piece of furniture at Capodimonte. I had entertained hopes of interesting some of the younger astronomical aspirants in variable star observation, but when the Little Man told me sadly, that he knew of no single person in this metropolis of over three-quarters of a million souls whose services I could hope to enlist, I exploded with indignation. At this, Bemporad leaned over and pressed my hand, in mute appreciation of my sympathy. Here indeed was a Prophet, not without honor, save in his own city; but he declared that like Kepler, he would persist, knowing that someday good use would be made of his work.

We were now invited to his domicile for refreshment. He and his family dwell in quarters within the great edifice; to reach which we traversed arched tunnels and quaint court-yards, near one of which he showed us the "Astronomer's Garden"—full of good green vegetables

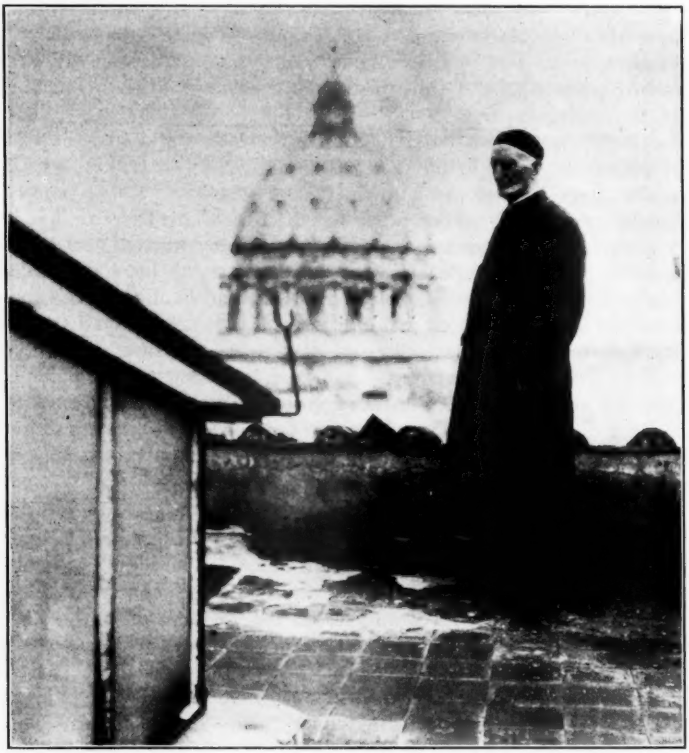
and colorful flowers and vines. Cousin Guilio had preceded us to the modest apartment in order to prepare the coffee and pick for my wife some lush red camellia buds. Bemporad explained regretfully that his wife and sixteen year old daughter were spending the day in town. Lying on a table was the latter's violin. How the Italians love music and flowers! They seem born to a keener appreciation of beauty than most others—and with the strong urge to express it. Two sons—of fourteen and fifteen years respectively—were at school, but we met the elder, a youth in his twenties, who exhibited a fully equipped miniature railway, which he had been many years in constructing. It was a marvel of perfection and fully justified the father's pride in his son's accomplishment.

Thus in this strangest but friendliest of places, we sipped the black oil of coffee—so loved by all Italians—and ate the little cakes, sensing, the while, the pride and contentment of our host.

The day was fading as we prepared to leave. The Director handed me a generously inscribed monograph, written by himself, on Photographic Magnitudes, while I was glad, in return, to have him accept some copies of our newer variable charts. Cousin Guilio insisted upon escorting us to the tram, and turning, as we entered the first of the red-blossomed, tunneled paths leading to the exit, we caught our last glimpse of Bemporad—standing alone—still with that kindly smile, his hand raised high in adieu. Out through the twilight we carried a kindlier feeling toward all mankind, because of the kindly courtesy and generous hospitality of this lonely little worker in the gray smock.

After a fortnight spent amid the orange groves of beautiful Sorrento, we left the shores of Southern Italy for that city—greatest of all in art and antiquity—wherein the mighty Mussolini exercises his benevolent autocracy over a happy and united people. Rome, whose infinite variety never tires, feeds the tourist from an ever changing menu of all things beautiful. So much of this centers about the history and art of St. Peter's and the Vatican, that one is drawn to this quarter, over the brown Tiber, again and again. It was on our first visit hither, however, that upon leaving the bewildering immensity of the Vatican museums—to reach which one must skirt the walls of the great cathedral for half its circumference—we found ourselves, almost immediately before a small, rough doorway in a massive wall. The porter was summoned, a covered stone stairway climbed, and we were amid the ancient relics that are scattered profusely among the luxurious foliage of the Vatican Gardens. Paths, bordered by hedges that rose twenty feet or more above our heads, seemed to lead in every direction across the undulating sward. Nearby, on a cleared rise of ground, was the strikingly simple, iron-canopied pavillion, with its equally simple iron table and chairs, wherein the Pope, with gentlemen of his household, is accustomed to take his afternoon repose. It was from this vantage point that we caught our first glimpse of the Vatican Observa-

tory. A low yellow building, with buttressed roofing, stood adjacent to a great stone tower, supporting a graceful dome. In the background rose St. Peter's, surmounted by its golden ball and cross. On nearer approach we discovered a broad wall of rough stone, perhaps thirty feet in height, extending from the tower eastward, for nearly a quarter of a mile. Two other domes, of lesser dimensions than the first, sur-



Father Hagen on the Roof of his Observatory.
(St. Peter's in the background.)

mounted tower bases midway and at the end of this wall, along the top of which were guard rails converting it into a pathway connecting these observatories. This wall, with its three round fortresses, we learned later, had been built by the people of the Vatican one thousand years ago, against the incursions of the Saracens.

It was thus we came upon the home and work-shop of Father J. G. Hagen, S.J.—the venerable astronomer-priest whom Pius X had called

from the Georgetown University, in America, twenty years ago, to become the Astronomer of the Vatican.

On the high walls of the great airy library, to which we were soon admitted, hung many photographs of celestial objects. In the windows were transparancies of others. Files of books and records burdened the ceiling-high shelves, while a massive oaken table held stacks of astronomical magazines and pamphlets. Conspicuous among these, our eyes caught the familiar color of POPULAR ASTRONOMY. From this room opened others, splendidly lighted, containing time-pieces, thermal instruments and wireless apparatus—all shiningly bright and precisely arranged.

Now down the stone steps, leading from his study, came a tall straight figure in long black gown and skull-cap. The clear eyes seemed twinkling from a face of marked ascetic type. Here was the man, whose life work means so much to all students of variable stars.

He welcomed us in a voice low and musical—having but the slightest German accent. Despite the fact we were necessarily interrupting his labors—since every minute, night and day, of his waking hours is devoted to the work he loves—his greeting was warm and cordial and he seemed eager to have us see his instruments and exhibits. As we entered the rotunda below the large dome, our eyes caught the gold stars of the constellations, frescoed against a blue ground upon the arched ceiling, while all about the circular chamber were splendid transparencies of famous astronomical objects, made largely from photographs taken at Harvard, Yerkes, and Flagstaff. By means of a massive stone stairway, we reached the electrically operated dome above, beneath which was housed a beautiful sixteen-inch refractor. We learned that here was probably the only telescope of its size in the world, not mounted upon a grounded central pier. It is supported alone by the walls of this ancient fortress. Earthquakes that have nearly thrown Father Hagen from his bed have failed to disturb the accuracy of its setting. At the eye-piece of this instrument, upon every clear night, this remarkable man is stationed; still striving to solve the mysteries of space with a persistence that would appal most men of half his years.

From the railed balcony that surrounds the base of the dome, we obtained a splendid panorama of Rome, with the cathedral—that masterpiece of Michael Angelo's—rising in the foreground, just beyond the walls of the Garden.

Seated once more in the library, we listened to a recital of the almost single-handed efforts of twenty years ago, required to convert the one-time Summer-house of the Pope, into the modern observatory it now is. Even today Father Hagen's only assistants are a Secretary and a caretaker. The latter, however, has been taught to use one of the smaller glasses, and now is capable of executing all of the photographic work.

Before us on the wall hung a portrait inscribed Eduardo Carlos Pickering, and the good Father told us that he believed Pickering and

Newcomb to have been America's greatest astronomers. With enthusiasm he expressed his great admiration for Dr. Shapley of Harvard, in whose conclusions he said he placed the greatest confidence.

Seldom, if ever, does Father Hagen leave the Vatican Gardens; but he told us, with a twinkle in his eye, that unlike the Pope, he could leave if he cared to. Our remarks upon the prosperity so evident all about us, and in such contrast to the conditions we had observed farther south, led him to explain that his funds were derived directly from the Pope, and were always ample. He felt, he said, that he should be kind to his American friends, since so large a part of his resources came, indirectly, from their country. Perhaps, under the administration of a Pope less interested in scientific research than Pius X or Pius XI, it might be difficult to obtain the necessary funds for carrying on the work; but then Father Hagen would, without hesitation, but still with that twinkle in his eye, use the argument of the splendid propaganda that is created by the sight of the Church furthering the advancement of Science. Regarding the peculiar juxtaposition of science and religion, that makes his environment, it was good to hear him say: "They go perfectly together—I practice both."

It was with a feeling of pride that we heard this master of variable star observers declare the A.A.V.S.O. to be the greatest organization engaged in this work in the world. He was pleased to hear of the extensive service to which we were putting his charts and gave us *carte blanche* to copy for our use any or all as we saw fit. "No permission need be asked," said he, "all my work is free to all who are striving for the same end. There are no publishers interested in their sale—I have sole control." As we discussed recent astronomical progress and spoke of the great part the Cepheids have played in the determinations of space, he remarked, wistfully: "Yes, the Universe has grown—grown since I was a boy. I don't think I know as much about astronomy now as I thought I did fifty years ago. Mine is a very narrow field."

He then showed us his work on the *Carte du Ciel* and deplored the conflicts and contentions delaying its progress. He liked better the "Patrol of the Sky" recorded on the plates stored in the Brick Building at the Harvard College Observatory. In speaking of his famous Star Atlas, he disclosed the fact that he contemplates issuing two new series: Series VII, to contain still more of the faint variables, being a continuation of Series VI; and Series VIII to be a continuation of Series IV.

Before leaving he did me the honor of asking me to write my name in a great book, which with seeming tenderness, he brought from its glass case, where it reposed under lock and key. As he gently turned the leaves, few of which were inscribed, he said quietly: "I will be gone a long while before this is filled. You will be the third Pickering to sign it." Proud indeed was I to place my signature in with such goodly company: Eddington, Turner, Campbell, Frost, Parkhurst, Rodez, Yamamoto. . . . But here was a vacant space, barely an inch wide,

bearing the dates 1914-1918, during which period no one had called at the Observatory to interrupt the constant work of the genial priest.

He sped our parting with kind felicitations to his friends in America and well-wishes for the success of our work.

Upon leaving, we again traversed the great Piazza St. Peter, between the circling rows of columns that represent the receptive arms of the Church—their austerity now softened by the thought of the tolerance and grace of the kind old gentleman who had been our host. Better than ever before, we seemed to grasp the significance of the sacred phrase: "Faith without works is dead."

Late on an April Saturday we were ending a picturesque journey that had carried us higher and higher into the foot-hills of the Apennines. We had been enjoying the novelty of stretching our lengths on the red plush cushions of our compartment; thrilling at the noiseless, jarless manner in which our train, after each of its numerous halts, glided into motion in response to the toy toot of the guard's toy horn. Thus we came to Florence—whose very name fires the imagination and compels the respect of artists and historians the world over. At our hotel we found the card of the Marchese Nello Venturi Ginori, and by phone arranged a meeting with him for the morrow. This truly delightful, highly cultured and much-traveled gentleman, has long been an ardent student of variable stars and a valued contributor to our reports. Fortunate indeed were we to have had his services as Guide, Philosopher and Friend for even one day—for on the next, he was departing, with an expedition, for Africa.

As we motored with him, the following afternoon, to visit the Royal Observatory, he directed our attention to his own private Observatory—a white spot in the far away hills that encircle Florence like a saucer's rim.

In a small yellow house, with a stubby turret, standing amid scrubby trees high in the hills of Arcetri—three miles from Florence—the great Galileo spent the last years of his life; permitted to return from exile to be near his daughter, who was an inmate of a nearby convent. Not many days since, we had stood before an obscure monument, nestling in the foliage of the roadside near the Pincio Gardens in Rome, dedicated to his "Moral Martyrdom."

Close to the site of his last home, many years ago, was built the Royal Observatory, in commemoration of this great man's achievements. Dr. Georgio Abetti, the young and energetic Director of this institution, is a son of the man, recently retired, who from the first had so loyally guided its destiny. He and the Marchese Ginori are great friends, and the latter is almost as conversant with the details of Observatory affairs and the operation of its instruments as the Director himself. Like the Observatory buildings of Naples and Rome, here was room and equipment sufficient to house and profitably occupy the time and effort of an extensive staff. But like them also, the work is

being done almost alone by the Director. A young student from the local University, Attilio Colacevich, who aspires to make Astronomy his profession, is the protege and helper of Dr. Abetti—his only assistant. This young man's interest in variable stars induced me to offer him membership in the A.A.V.S.O., which he seemed glad to accept.

As we passed through the library and adjacent rooms, we marvelled at the mass of material these accommodated. Their shelves were replete with scientific works while the walls were hung with rare prints and many portraits. All were painstakingly arranged and bespoke loving care and orderliness.

Two of the three domes above the main building, house respectively a fifteen-inch and a six-inch refractor, while the third covers a splendid

The Royal Observatory, Arcetri, Italy.

twelve-inch Zeiss Newtonian prism spectroscope, having a six-inch Steinheil finder and camera attachment. The domes and instruments are controlled by modern, electric driven mechanism. The flat roof, that extends beyond the housing of the instruments atop the stone and concrete building, is protected by iron railings; and from here, where the visitor may be aided by the use of a three-inch glass, is afforded a glorious panorama of Florence, with the old Duomo and its famous Campinile rising majestically beyond that thin ribbon—the Arno, which, ever narrowing, looses itself at last in the western hills.

A graceful structure of steel and concrete rises at some distance from the older buildings. It is the recently completed tower telescope and its twelve-inch Zeiss glass and two flats are for spectroscopic use. Since Dr. George Hale, who visited Arcetri not so long ago, contributed most

generously to its cost, it is obvious that it had for its inspiration its larger prototypes at Mt. Wilson. It was pleasing to learn that another who was helpfully interested in this project was the elder Ellsworth, recently deceased, whose son, Lincoln, became a member of the A.A.V.S.O. just before achieving fame with Amundson in the far north.

Dr. Abetti is largely interested in solar work and at the time of our visit was engaged in observing the radial motions of sun-spots, while also undertaking part of the International Union's program for the observation and recording of solar prominences. He has also achieved much in the determination of spectroscopic parallax.

The Director's home stands close by the Observatory, and where could one find a more charming hostess than that vivacious young matron, his wife? As we sat having tea with them there, on a later day, evidences of her domestic handiwork were all about us. We made great friends with Pierre Antonio—that five year old bouncing bundle of energy and, from observing him, learned that the charming Signora was a competent mother as well as a capable housewife.

Both Dr. and Mrs. Abetti have visited America in recent years and hold our country and its people in high regard. How we urged them to return, now that we had found them such jolly companions. Only recently had Mrs. Abetti acquired a knowledge of English; but her mastery of it was another evidence of the facility which the Latin has for linguistic accomplishment.

The hospitality and friendliness of these dear people, who had so generously showered with favors the strangers within their gates, made us loath to forego their companionship; and when we were at last about to move northward, it was like parting from old friends, to say good-bye.

To reach the ancient town of Faenza, one travels northeastward from Florence across the barren grandeur of the Apennines. The town is famous for its Majolica ware or "faience." There lives a man, who for many years has been one of the "Old Guard" of the A.A.V.S.O., and with whom I had long enjoyed the pleasure of corresponding. The observations of Signor G. B. Lacchini, under the familiar designation "L," have appeared in POPULAR ASTRONOMY among the monthly records of the A.A.V.S.O. with persistent faithfulness, for years. The pleasure of meeting him had been anticipated with enthusiasm.

As the train came to a stop at the station, I at once recognized the slender face with its strong features and Van Dyke beard. He stood in the center of a little expectant group—a matronly lady, a young girl and two young men. Signor Lacchini had taught himself very thoroughly to write and read English, but was quite unfamiliar with the sounds of the spoken words. His embarrassment at being unable readily to express himself was evident. The others had no English whatever, but despite this and the fact that we knew nothing of Italian,

we were soon madly chattering and gesticulating in the midst of as warm a welcome as we had ever received. His lovely daughter, Bianca Rosa—or White Rose—had brought a great bouquet of flowers for my wife. We were presented to Signora Lacchini and to the two young men—Signors Benini and Ancarini—who are proteges of Lacchini's whom he had interested in astronomy and taught to observe. Both had

Left to right: BENINI, PICKERING, LACCHINI, ANCARINI,
Faenza, Italy.

recently joined our Association. Accordingly, in the picturesque remoteness of this little town, hidden away in northern Italy, we four members of the same society, prepared to hold a meeting of the A.A.V.S.O.

Except for the two young men now with him, I was the first member of the Association whom Lacchini had ever met. The thought that, despite this lack of cheer and comradeship, he was urged ever to greater achievement through love of the work alone heightened my respect and admiration for this student of the stars.

A waiting carriage conveyed us to the Museo delle Ceramiche, where we enjoyed the extensive display of china and pottery of all lands and periods. We then drove out beyond the ruins of the walls of the ancient town, across open fields, to the characteristically pink stuccoed home of our host, where we were regaled with delicious cakes and cordial. Soon we were shown the study, devoted to the preparation and recording of variable star observations. On the walls hung pictures of our Cambridge meetings, together with astronomical charts and photographs; many of the latter taken by Lacchini himself with an improvised telescopic camera. Upon the roof of the dwelling was erected the telescope house, with a flat sliding roof, offering ample room to operate the good five-inch Mertz refractor which, together with a fine complement of oculars, he had lately acquired from Capodimonte to replace the older three-inch glass. Here, often with his younger companions—who have as yet no glasses of their own—this quiet man pursues his avocation; observing with a speed and accuracy that are the results only of long continued practice and great familiarity with the variable fields.

We celebrated the happy day with a dinner at the town inn—famous for its cooking. We still thrill at the memory of the luscious asparagus and strawberries and that good wine of Tuscany. What a merry time we had—becoming ever more adept in the universal language of signs and wordless sounds.

They were all at the station to bid us a cordial adieu when we left the next morning. From the broad windows of our compartment we watched the fading group waving farewell, as we again moved northward.

Just a fleeting hand-clasp it seemed—but how warm and sincere!

What an example this man sets for us all. His co-workers, scattered across the world, may be justly proud of him—so joyously has he overcome the difficulties of distance and language—so high is the standard of faithful service that he has created.

We had parted from the last of those Italian star lovers; all of whom had given us good reason to be thankful for our interest in a cause that boasts so fine a Brotherhood. As we sped toward Venice we looked eagerly forward to the pleasure of meeting other workers in other lands —all Brothers of the same great Fraternity.

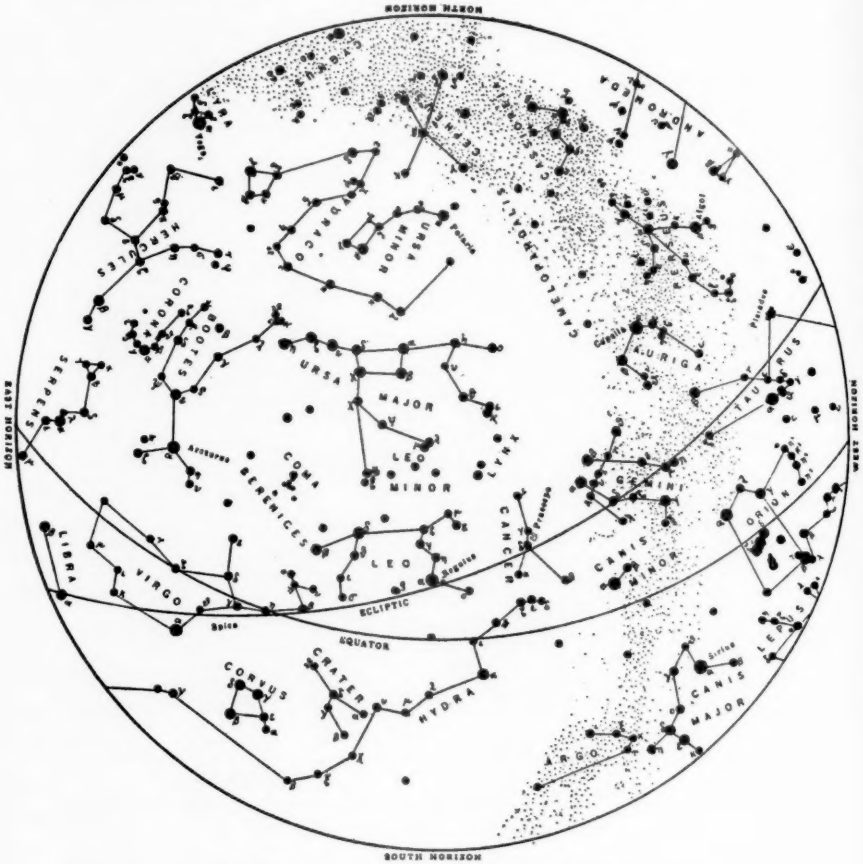
EDITORS' NOTE.

It will have been noticed by our readers that in the last few issues we have been able, through the generous coöperation of Professor G. Van Biesbroeck and Professor C. P. Olivier, to publish "Comet Notes" and "Meteor Notes" of exceptional interest and value. In addition, this month for the first time will be found some notes under the heading "The Sky for April," prepared by Mr. C. E. Smith. These, it is hoped, will be found useful and suggestive to those whose temperament is such as to respond to the appeal of the starry sky.

PLANET NOTES FOR APRIL.

By CLIFFORD E. SMITH.

The *Sun* will be moving northeast during April, crossing from Pisces into Aries about April 19. About April 24 it will be some 10.5 degrees south of α Aries. The positions of the sun on the first and last days of the month will be, respectively: R.A. $0^h\ 38^m$, Decl. $+4°\ 4'$, and R.A. $2^h\ 25^m$, Decl. $+14°\ 24'$.



THE CONSTELLATIONS AT 9:00 P. M. APRIL 1.

The phases of the *Moon* for April will occur as follows:

New Moon	April 1 at	10 P.M.	C.S.T.
First Quarter	8 "	6 P.M.	"
Full Moon	16 "	10 P.M.	"
Last Quarter	24 "	4 P.M.	"

The moon will be at perigee (the place in the moon's orbit nearest the earth) on April 1 and April 30, and at apogee (farthest from the earth) on April 15.

Mercury will be visible for an hour or more before sunrise during the entire month. The most favorable time for observation will be about April 8, when it will be in conjunction with Jupiter. They will then be less than half a degree apart. Also on April 17 Mercury will be in conjunction with Uranus. These two planets will be about two degrees apart at conjunction. Mercury will be in the constellation Pisces during April.

Venus during April will be the most striking object in the western sky. Its apparent motion will be from the central part of Aries to the central part of Taurus and eastward from the sun. At the end of the month it will set about 2½ hours after the sun. Venus will be at perihelion on April 28.

Mars will be in the evening sky north and some two hours west of Venus. At the beginning of the month Mars will be in Taurus, but at the end of the month it will be in Gemini about two degrees from ε Geminorum. Mars will be on the western horizon about ten o'clock at the end of the month.

Jupiter will be near the border of Pisces west of the sun. Jupiter will be a morning star, and it will rise about three hours before the sun during the last part of the month. As has been mentioned previously, Mercury and Jupiter will be in conjunction on April 6.

Saturn will be in Ophiuchus about six degrees north of Antares. Saturn is coming into position where it will be visible most of the hours of the night. On April 30 it will rise about 10 P.M.

Uranus will be a morning object in Pisces. At the end of the month it will rise about two hours before the sun.

Neptune will be an evening object in Leo about five degrees west and north of α Leonis. During the latter part of the month it will set about two-thirty A.M.

THE SKY FOR APRIL.

(9 P.M., APRIL 15; LATITUDE 45° N.)

By CLIFFORD E. SMITH.

The evening sky for April will be the most interesting and most striking of the entire heavens. Near the western horizon will be Orion and Taurus, surrounded by Canis Major on the south, Canis Minor, Gemini, and Auriga on the east, and Perseus on the north. If a steep arch could be drawn in the western skies, resting on the western horizon, beginning at the southwest, rising to an altitude of about sixty degrees in the west, and descending again in the northwest, it would pass near seven of the brightest stars in the sky. Beginning in the southwest one would notice that Sirius (the brightest star in the heavens) would be the first star in the arch, only about fifteen degrees above the horizon. Farther up the arch, having an altitude of about forty-four degrees would be Procyon. Looking directly west, now, towards the peak of the arch at an altitude of about sixty degrees one would see Pollux and Castor, the Twins. On the opposite side of the arch from Procyon would be Capella and on the opposite side from Sirius, Algol. On a line between Sirius and Algol about one-third the distance from Sirius would

be the belt of Orion, parallel to the horizon, with, of course, the bright star Betelgeuse above the belt and Rigel below the belt. About two-thirds the way from Sirius to Algol would be the bright star in the Hyades, Aldebaran (α Tauri). About ten degrees to the right of Aldebaran will be Venus only three or four degrees from the Pleiades. About fifteen degrees directly above Aldebaran will be Mars, somewhat to the left of β Aurigae and about half-way between Betelgeuse and Capella.

About twenty degrees south from the zenith one will see Regulus, the bright star in the end of the handle of the sickle in Leo. Then as one looks toward the southeast one sees Spica (α Virginis) about twenty degrees from the horizon. Turning now towards the east one can see Arcturus (α Bootes) about forty-five degrees from the zenith, and somewhat below and about ten degrees to the left, α Coronae.

Finally, turning to the northeast one will see the "Big Dipper" high in the sky, the pointers being almost on the meridian (the line through the north star directly north and south), and low in the northeast the bright bluish star Vega (α Lyrae) hardly five degrees above the horizon.

METEOR NOTES.

By CHARLES P. OLIVIER.

It is important that those engaged in observing meteors should be acquainted with the literature of this branch of astronomical work. Many also who do not actually observe meteors for the purpose of recording results are interested in thorough and authentic treatises of them. It has, therefore, been thought advisable to review in these notes this month one such work which has appeared recently. The work referred to is KATALOG DER BESTIMMUNGSGRÖSSEN FUR 611 BAHNEN GROSSER METEORE VON GUSTAV VON NIESSL, prepared for publication by C. Hoffmeister.

The work of Gustav von Niessl in the field of meteoric astronomy was so important and extended over so many years that every student of the subject must assign him a place of the highest rank. German meteroic astronomy has been fortunate in finding a worthy successor to von Niessl, namely C. Hoffmeister, who has recently completed the catalogue now under discussion.

The study of fireball paths most particularly interested von Niessl, and for several decades he industriously gathered observations of these bodies and developed with great skill methods for deriving the best results from the heterogeneous data available. At his death he left in manuscript form a catalogue containing not only the numerous results of his own computations of heights and paths of fireballs, but also those from all other available sources. Frequently not content with the original work of others he had recomputed in doubtful cases, using his own methods, and in most of them derived more accurate values.. In addition to the tables of data themselves, notes of the greatest importance are added when desirable. These notes describe the difficulties and inconsistencies which frequently made recomputation a necessity.

After von Niessl's death, the manuscript and computations were handed over to Hoffmeister to edit and publish. To the 518 fireballs in the original, he added 93 more. Some of these he has personally computed, following in general von

Niessl's methods; the rest are results by others. Hoffmeister where possible has corrected mistakes in von Niessl's manuscript, and to him belongs the very real credit for getting the whole into excellent form for publication. As it stands we have the first complete catalogue of the radiants, elongations from apex and sun, heights, lengths of paths, and velocities for 611 fireballs, some of which ended as meteorites, in which all necessary data are given for a general study. References to the original authorities for each case are added.

Turning to the notes we find, for example, a special study of the Taurid fireball stream, which has an almost stationary radiant lying near the ecliptic—the only position in which one could expect to find a stationary radiant. Also many cases in which retardation is clearly proved as the object nears the earth's surface, and fresh proof (if any is desired) that the most fundamental thing meteoric astronomy needs is accurate velocities. Several other fireball groups are proved to exist. But one must read the notes to appreciate the wealth of information contained in them. The last table gives the radiants, divided into three zones, and then arranged according to right ascension. This will aid in the detection of other fireball groups. The only criticism that the writer cares to make is that the value of the catalogue would have been considerably enhanced, possibly without excessive additional labor, had the elements of the orbits also been given, at least for the best determined cases. But as it stands it is a work of the highest value.

Hoffmeister by the editing and publication of this excellent catalogue, as well as by his own numerous additions thereto, has greatly added to his already high reputation as one of the authorities in this branch of astronomy. The catalogue is strongly recommended to every person interested in meteors.

The catalogue consists of 60 pages from the 100th volume of the *Publications of the Vienna Academy of Sciences*. It was published in 1925 though probably only distributed in 1926. It may be obtained from Hölder-Pichler-Tempsky, A.G., Vienna and Leipzig, Publishers.

COMET NOTES.

By G. VAN BIESBROECK.

Comet 1927 *c* (Reid).

As mentioned in a short note last month the second cometary discovery of the year is due to Mr. William Reid at the Cape. The name of this southern observer has figured prominently in the comet discoveries of the last decade. The object that he found on January 25 was of magnitude 8 but its far southern declination precludes observations in this hemisphere. The following first orbit has been transmitted telegraphically by the Cape Observatory.

Time of perihelion:	T = 1926 Dec. 30.54 U.T.
Perihelion minus node	= 224° 45′
Longitude of node	= 108 42
Inclination	= 83 40
Perihelion distance	= 0.753

The name of the computer of these elements is not given. L. Cunningham and F. S. Hogg (Harvard Coll. Obsy. Announcement Card 17) have deduced the ephemeris from these elements:

U.T. 1927		α h m	δ ° ′	Log. r	Log. Δ	Mag.
March	4.0	3 25.0	—30 59	0.144	0.157	9.1
	20.0	4 16.8	—17 15	0.208	0.237	9.8
April	5.0	4 53.2	— 7 36	0.264	0.320	10.5
	21.0	5 22.4	— 0 59	0.313	0.395	11.1
May	7.0	5 47.7	+ 3 33	0.356	0.458	11.8
	23.0	6 10.4	+ 6 44	0.394	0.509	12.1
June	8.0	6 31.2	+ 8 57	0.429	0.551	12.5
	24.0	6 50.4	+10 30	0.460	0.584	12.8
July	10.0	7 8.1	+11 34	0.488	0.610	13.1

It appears that the object may perhaps be seen even from northern latitudes after the middle of March. However its angular separation from the sun will be small and the conditions of visibility unfavorable.

COMET 1927 *a* (BLATHWAYT).

From the elements given last month A. Crommelin has computed this ephemeris for 0^h U.T. (B.A.A. Circular 49):

1927		α h m	δ ° ′	Log. r	Log. Δ
March	2	0 2.7	—62 38	0.041	0.103
	18	1 34.3	47 12	.077	.184
April	3	2 11.6	35 40	.124	.262
	19	2 34.1	27 42	.174	.324
May	5	2 50.8	22 7	.223	.370
	21	3 3.9	18 11	.269	.402
June	6	3 14.1	15 27	.311	.421
	22	3 21.3	—13 40	0.349	0.429

It will not come in reach of northern observers unless perhaps in the summer, after it has lost considerably in brightness.

The different comets now visible from our latitude are all faint and little conspicuous:

a) PERIODIC COMET 1926 *e* (GIACOBINI-ZINNER) had faded to magnitude 13 on Feb. 4. The object will not be followed very much longer. On Feb. 20 I estimated the magnitude as 14. The tail was quite faint on that date.

b) COMET 1926 *f* (COMAS SOLÁ) has lately shown a sharper nucleus which makes good measurements possible even in moonlight, although the magnitude is not brighter than 13 (Feb. 20). The short tail is still well visible.

There have come to hand two independent determinations of the elements based on observations covering nearly two months:

	Elements Ch. Smiley and M. Holbrook (Lick Obs. Bull. 382)	Elements A. Crommelin (Copenhagen Circ. 131)	
Dates of Observations	Nov. 8, Dec. 6, Dec. 28	Nov. 10, Dec. 3, Dec. 24	
Time of Perihelion (U.T.)	1927 Mar. 22.1951	1927 Mar. 22.1992	
Perihelion minus node	38° 27′ 42″.7	38° 27′ 30″.8	1926.0
Longitude of node	65 36 57.0	65 36 29.2	1926.0
Inclination	13 45 17.8	13 45 40.0	1926.0
Perihelion distance	1.77230	1.772716	
Semi-major axis	4.16047	4.17035	
Eccentricity	0.574015	0.574924	
Period in years	8.4862	8.516453	

The orbit is already well determined and the additional measures of this year will still more reduce the range of uncertainty. A. Crommelin gives the follow-

ing ephemeris which hardly differs from the one obtained by the Berkeley computers:

U.T. 1927	α h m s	δ ° ′
Feb. 1.0	2 49 52	+20 26
9	3 2 10	22 14
17	16 13	23 59
25	32 6	25 41
Mar. 5	3 49 28	27 16
13	4 8 32	28 44
21	28 49	30 2
29	4 50 37	31 11
Apr. 6	5 12 44	32 2
14	36 6	32 41
22	5 59 56	33 3
30	6 24 6	+33 14

c) Comet 1925 *a* (Shajn) becomes a very faint object. On February 4 it was last seen here visually as a small round nebulosity, some 10″ in diameter and not brighter than magnitude 16. It was photographed on Feb. 20 and 22 as a faint diffuse nebulosity.

d) Periodic Comet 1926 *g* (Neujmin) has been observed here several times on its southward path. On Feb. 10 its brightness was estimated as of magnitude 11. Although it passed perihelion on Jan. 16 its apparent brightness still increases, owing to the closer distance to the earth. It will soon be in reach of southern observers only.

No success has been reported yet in finding the two expected periodic comets Grigg-Skjellerup and Pons-Winnecke, for which search ephemerides were given on p. 119. An interesting account of the work done on the orbit of the first of these comets by Dr. G. Merton is found in the January number of *Observatory* (pp. 4-7). Mr. F. E. Seagrave sends the following ephemeris based upon his independent elements:

Time of perihelion	T = 1927 May 10.34 U.T.
Perihelion minus node	355° 2′ 50″.82
Longitude of node	215 26 34.20
Inclination	17 31 19.55
Log. *e*	9.843085
Log. *q*	9.948851
Mean motion	707″.001

U.T. 1927	α h m s	δ ° ′ ″	Log. *r*	Log. Δ
Mar. 3.0	5 32 15	−9 15 29	0.121	9.867
7	5 32 18	−8 30 9	0.109	9.860
11	5 33 11	−7 41 31	0.096	9.853
15	5 34 52	−6 51 5	0.083	9.844
19	5 37 20	−5 57 23	0.069	9.834
23	5 40 32	−5 0 55	0.056	9.823
27	5 44 28	−4 1 9	0.043	9.810
31	5 49 5	−2 57 50	0.030	9.795
Apr. 4	5 54 25	−1 49 55	0.017	9.779
8	5 59 39	−0 40 41	0.005	9.760
12	6 6 59	+0 43 43	9.994	9.738
16	6 14 13	+2 13 4	9.983	9.715
20	6 22 7	+3 53 52	9.973	9.688
24	6 30 34	+5 49 39	9.965	9.658

The positions differ only by a small quantity from the ephemeris given here last month. It is hoped that the object will soon be recovered since the observing conditions are improving.

VARIABLE STARS.

Minima of Variable Stars of Short Period.

[Calculated by members of the classes in Astronomy at Carleton College.]

Given to the nearest hour in Greenwich civil time; to obtain Eastern Standard time subtract 5^h; Central Standard time 6^h, etc.

Star	R.A. 1900	Decl. 1900	Magnitude	Approx. Period	Greenwich civil times of Minima in 1927 April							
	h m	° ′		d h	d h	d h	d h	d h	d h	d h	d h	d h
SY Androm.	0 08.0	+43 09	9.5—13.0	34 21.8					17 3			
RT Sculptor.	31.5	—26 13	9.6—10.5	0 12.3	7 17	15 9	23 1	30 17				
U Cephei	0 53.4	+81 20	7.0— 9.0	2 11.8	6 2	13 13	21 1	28 12				
Z Persei	2 33.7	+41 46	9.4—12	3 01.4	6 18	12 21	18 23	25 2				
TW Cassiop.	37.6	+65 19	8.2— 9.0	1 10.3		8 0	16 13	25 3				
RY Persei	39.0	+47 43	8.0—10.3	6 20.7	4 18	11 14	18 11	25 8				
RZ Cassiop.	39.9	+69 13	6.9— 8.1	1 04.7	4 15	11 20	19 0	26 3				
TX Cassiop.	44.4	+62 22	9.4—10.1	2 22.2	3 10	12 5	20 23	29 18				
ST Persei	53.7	+38 47	8.5—10.5	2 15.6		8 7	16 5	24 4				
RX Cassiop.	2 58.8	+67 11	8.6— 9.1	32 07.6	5 11							
Algol	3 01.7	+40 34	2.3— 3.5	2 20.8	3 8	11 23	20 13	29 4				
RT Persei	16.7	+46 12	9.5—11.5	0 20.4	5 21	12 16	19 11	26 6				
λ Tauri	55.1	+12 12	3.3— 4.2	3 22.9	6 1	14 23	22 20	30 18				
RW Tauri	3 57.8	+27 51	7.1— [11	2 18.5	5 18	14 2	22 9	30 16				
RV Persei	4 04.2	+33 59	9.5—11.0	1 23.4	5 19	13 17	21 14	29 11				
RW Persei	13.3	+42 04	8.8—11.0	13 04.8		10 9	23 14					
SZ Tauri	31.4	+18 20	7.2— 7.7	3 03.6	3 5	9 12	22 2	28 9				
RS Cephei	4 48.6	+80 06	9.5—12.0	12 10.1		7 6	19 16					
TT Aurigae	5 02.8	+39 27	7.8— 8.7	0 16.0	2 0	8 16	22 0	28 16				
RY Aurigae	11.5	+38 13	10.7—11.7	2 17.5	5 14	13 18	21 22	30 2				
RZ Aurigae	42.9	+31 40	10.6—13.3	3 00.3	3 6	9 7	21 8	27 8				
SV Tauri	45.8	+28 05	9.4—11.0	2 04.0	5 12	14 4		22 20				
Z Orionis	50.2	+13 40	9.7—10.7	5 04.9	1 12	11 21		22 7				
SV Gemin.	54.6	+24 28	9.8— [11	4 00.2	5 11	13 12	21 12	29 12				
RW Gemin.	5 55.4	+23 08	9.5—11.0	2 20.8	3 2	8 19	20 6	26 0				
U Columbæ	6 11.2	—33 03	9.2—10.0	2 19.2	4 12	10 3	21 8	26 22				
SX Gemin.	22.0	+20 37	10.8—11.5	1 08.8	4 3	12 8	20 13	28 18				
RW Monoc.	29.3	+ 8 54	9.0—10.8	1 21.7	6 17	14 8	21 23	29 14				
RX Gemin.	43.6	+33 21	8.8— 9.6	12 05.0	7 7		19 12					
RU Monoc.	6 49.4	— 7 28	9.8—10.5	0 21.5	7 17	14 22	22 2	29 6				
R Can. Maj.	7 14.9	—16 12	5.8— 6.4	1 03.3	2 6	9 2	22 17	29 12				
RY Gemin.	21.7	+15 52	8.9— [10	9 07.2	1 14	10 21	20 5	29 12				
Y Camelop.	27.6	+76 17	9.5—12	3 07.3	3 3	9 18	22 23	29 14				
TX Gemin.	30.3	+17 08	10.0—11.9	2 19.2	2 1	10 11	18 20	27 6				
RR Puppis	43.5	—41 08	9.4—10.7	6 10.3	4 18	11 4	24 1					
V Puppis	7 55.4	—48 58	4.1— 4.8	1 10.9	6 14	13 21	21 4	28 10				
X Carinæ	8 29.1	—58 53	7.9— 8.7	0 13.0	5 11	13 14	21 17	29 20				
S Cancri	8 38.2	+19 24	8.2—10	9 11.6		7 4	16 15	26 3				
RX Hydræ	9 00.8	— 7 52	9.1—10.5	2 06.8	3 9	10 5	23 22	30 18				
S Velorum	29.4	—44 46	7.8— 9.3	5 22.4	1 6	13 3	19 2	30 23				
Y Leonis	9 31.1	+26 41	9.3—11.2	1 16.5	3 16	10 10	23 17	30 15				
RR Velorum	10 17.8	—41 36	10.0—10.9	1 20.5	8 4	15 14	23 1	30 10				
SS Carinæ	10 54.2	—61 23	12.2—12.8	3 07.2	3 8	9 22	23 3	29 18				
ST Urs. Maj.	11 22.4	+45 44	6.7— 7.2	8 19.2		8 3	16 22	25 17				
RW Urs. Maj.	35.4	+52 34	10.3—11.4	7 07.9	4 5	11 13	18 21	26 5				
Z Draconis	11 39.8	+72 49	9.9—13.6	1 08.6	1 15	8 10	21 23	28 18				
RZ Centauri	12 55.6	—64 05	8.5— 8.9	1 21.0	3 6	10 18	18 6	25 18				
RS Can. Ven.	13 06.3	+36 28	7.5—12.5	4 19.1		9 21	19 11	29 2				
SS Centauri	07.2	—63 37	8.8—10.4	2 11.5	3 18	11 4	18 15	26 1				

Minima of Variable Stars of Short Period—Continued.

Star	R.A. 1900	Decl. 1900	Magnitude	Approx. Period	Greenwich civil times of Minima in 1927							
					April							
	h m	° ′		d h	d h	d h	d h	d h	d h	d h	d h	d h
SX Hydræ	13 39.0	−26 23	8 6—12.7	2 21.5	1 11	10 14	18 20	27 13				
δ Libræ	14 55.6	− 8 07	4.8— 6.2	2 07.9	4 9	11 9	18 8	25 8				
U Coronæ	15 14.1	+32 01	7.6— 8.7	3 10.9	7 14	14 11	21 9	28 7				
TW Draconis	15 32.4	+64 14	7.3— 8.9	2 19.4		9 6	17 17	26 2				
SS Libræ	15 43.4	−15 14	9.3—11.5	0 18.4	4 13	11 17	18 22	26 3				
SW Ophiuchi	16 11.1	− 6 44	9.2—10.0	2 10.7	2 11	9 19	17 3	24 11				
SX Ophiuchi	12.6	− 6 25	10.5—11.2	2 01.5	2 12	10 18	19 0	27 6				
R Aræ	31.1	−56 48	6.8— 7.9	4 10.2	2 10	11 7	20 3	28 23				
TT Herculis	16 49.9	+17 00	8.9— 9.3	20 18.1		11 1						
TU Herculis	17 09.8	+30 50	9.5—12	2 06.4	7 1	13 20	20 16	27 11				
U Ophiuchi	11.5	+ 1 19	6.0— 6.7	1 16.2	2 2	10 12	18 21	27 6				
u Herculis	13.6	+33 12	4.6— 5.4	2 01.2	1 18	7 21	20 5	26 8				
TX Herculis	15.4	+42 00	8.3— 9.0	2 01.4	1 4	7 8	19 17	25 21				
RV Ophiuchi	29.8	+ 7 19	9. —12	3 16.5	7 16	15 1	22 10	29 19				
SZ Herculis	36.0	+33 01	9.5—10.3	0 19.6	5 2	13 6	21 11	29 15				
TX Scorpii	48.6	−34 13	7.5— 8.2	0 22.6	7 22	15 11	23 00	30 13				
UX Herculis	49.7	+16 57	8.8—10.5	1 13.2	1 16	9 10	17 4	24 22				
Z Herculis	53.6	+15 09	7.1— 7.9	3 23.8	2 9	10 9	18 9	25 8				
WX Sagittarii	53.6	−17 24	9.2—10.8	2 03.1	1 15	10 4	18 16	27 5				
WY Sagittarii	17 54.9	−23 01	9.5—10.6	4 16.0	3 19	13 3	16 19	27 3				
SX Draconis	18 03.0	+58 23	9.3—10.5	5 04.1	3 23	14 7	19 11	29 19				
RS Sagittarii	11.0	−34 08	5.9— 6.3	2 10.0	7 17	14 18	22 5	29 11				
V Serpentis	11.1	−15 34	9.5—11.1	3 10.9	6 11	13 9	20 7	27 4				
RZ Scuti	21.1	− 9 15	7.4— 8.3	15 03.2		10 12		25 15				
RZ Draconis	21.8	+58 50	9.5—10.2	0 13.2	3 13	10 17	17 21	25 1				
RX Herculis	26.0	+12 32	7.0— 7.6	0 21.3	2 11	9 14	23 19	30 22				
SX Sagittarii	39.7	−30 36	8.7— 9.8	2 01.8	6 5	14 12	22 20					
RR Draconis	40.8	+62 34	9.3—13	2 19.9	5 22	14 10	22 21					
RS Scuti	43.7	−10 21	9.3—10.3	0 15.9	7 10	14 1	20 17	27 8				
β Lyræ	46.4	+33 15	3.4— 4.1	12 21.8	4 2		17 0	29 21				
U Scuti	18 48.9	−12 44	9.1— 9.6	0 22.9	3 14	11 6	18 21	26 12				
RX Draconis	19 01.1	+58 35	9.3—10.2	1 21.4	2 9	9 23	17 12	25 2				
RV Lyræ	12.5	+32 15	11. —12.8	3 14.4	2 0	9 5	23 15	30 19				
RS Vulpec.	13.4	+22 16	6.9— 8.0	4 11.4	6 7		15 6	23 5				
U Sagittæ	14.4	+19 26	6.5— 9.0	3 09.1	6 7	13 1	19 19	26 13				
Z Vulpec.	17.5	+25 23	7.3— 8.5	2 10.9	6 21	14 6	21 15	28 23				
TT Lyræ	24.3	+41 30	9.4—11.6	5 05.8	1 1	11 12	16 18	27 6				
UZ Draconis	26.1	+68 44	9.0— 9.8	1 15.1	4 10	10 23	24 0	30 12				
SY Cygni	19 42.7	+32 28	10. —12	6 00.2	3 17	9 17	21 17	27 17				
WW Cygni	20 00.6	+41 18	9.3—13.4	3 07.6	3 4	9 19	23 1	29 17				
SW Cygni	03.8	+46 01	9. —11.7	4 13.8	4 19	13 23	18 12	27 16				
VW Cygni	11.4	+34 12	9.8—11.8	8 10.3	2 8	10 18	19 5	27 15				
RW Capric.	12.2	−17 59	8.8—10.6	3 09.4	5 10	12 4	18 23	25 18				
UW Cygni	19.6	+42 55	10.5—13	3 10.8	6 3	13 0	19 22	26 20				
V Vulpec.	32.3	+26 15	8.2— 9.8	37 19.0			19 5					
W Delphini	33.1	+17 56	9.4—12.1	4 19.4	3 16	13 6	18 2	27 16				
RR Delphini	38.9	+13 35	10.5—11.8	4 14.4	6 10		15 14	24 19				
Y Cygni	48.1	+34 17	7.1— 7.9	2 23.9	6 20		15 19	24 19				
WZ Cygni	49.3	+38 27	9.9—10.8	0 14.0	6 13	14 3	21 18	29 8				
RR Vulpec.	20 50.5	+27 32	9.6—11.0	5 01.2	3 22	14 0		24 2				
RY Aquarii	21 14.8	−11 14	8.8—10.4	1 23.2	2 10	10 6	18 3	26 1				
UZ Cygni	55.2	+43 52	8.9—11.6	31 07.3		8 6						
RT Lacertæ	21 57.4	+43 24	9.1—10.5	5 01.7	3 9	13 13	18 14	28 18				
RW Lacertæ	22 40.6	+49 08	10.2—11.2	5 04.4	2 2	12 11	17 15	28 1				
VW Pegasi	51.7	+32 42	10.0—10.6	5 06.4	4 4	14 17	19 23	30 12				
Y Piscium	23 29.3	+ 7 22	9.0—12.0	3 18.4	1 12	9 1	16 13	24 2				
TW Androm.	23 58.2	+32 17	8.6—11.5	4 02.9	3 16	11 22	20 4	28 10				

Maxima of Variable Stars of Short Period.

[Calculated by members of the classes in Astronomy at Carleton College.]

Given to the nearest hour in Greenwich civil time; to obtain Eastern Standard time subtract 5^h; Central Standard time 6^h, etc.

Star	R.A. 1900	Decl. 1900	Magnitude	Approx. Period	Greenwich civil times of maxima in 1927							
					April							
	h m	° ′		d h	d h	d h	d h	d h	d h	d h	d h	d h
SX Cassiop.	0 05.5	+54 20	8.6— 9.2	36 13.7								
SY Cassiop.	0 09.8	+57 52	9.3— 9.9	4 01.7			8 8		16 12		24 15	
RR Ceti	1 27.0	+ 0 50	8.3— 9.0	0 13.3	1 5		8 23		16 17		24 11	
RW Cassiop.	1 30.7	+57 15	8.9—11.0	14 19.2			10 1				24 20	
V Arietis	2 09.6	+11 46	8.3— 9.0	0 23.8	3 19		11 18		19 17		27 15	
SU Cassiop.	2 43.0	+68 28	6.5— 7.0	1 22.8	5 10		13 5		21 1		28 20	
RW Camelop.	3 46.2	+58 21	8.2— 9.4	16 00.0	5 9				21 18			
SX Persei	4 10.2	+41 27	10.4—11.2	4 07.0	5 1		13 15		22 5		30 19	
SV Persei	42.8	+42 07	8.8— 9.6	11 03.1	4 20				15 23		27 2	
RX Aurigæ	4 54.5	+39 49	7.2— 8.1	11 15.0	6 22				18 13		30 4	
SX Aurigæ	5 04.6	+42 02	8.0— 8.7	1 12.8	6 2		13 17		21 10		29 1	
SY Aurigæ	05.5	+42 41	8.4— 9.5	10 03.3			9 17		19 19		29 23	
Y Aurigæ	21.5	+42 21	8.6— 9.6	3 20.6	5 23		13 17		21 10		29 3	
RZ Gemin.	5 56.6	+22 15	9.1—10.0	5 12.7	5 18		11 7		22 9		27 21	
RS Orionis	6 16.5	+14 44	8.2— 8.9	7 13.6	8 1		15 15		23 5		30 18	
T Monoc.	19.8	+ 7 08	5.7— 6.8	27 00.3	5 11							
RT Aurigæ	23.0	+30 33	5.1— 6.0	3 17.5	2 2		9 12		17 0		24 10	
W Gemin.	29.2	+15 24	6.7— 7.5	7 22.0	3 15		11 13		19 12		27 9	
ζ Gemin.	6 58.2	+20 43	3.7— 4.3	10 03.7	5 2				15 6		25 10	
RU Camelop.	7 10.9	+69 51	8.5— 9.8	22 06.5					20 21			
RR Gemin.	7 15.2	+31 04	10.0—11.5	0 09.5	5 2		13 1		21 0		28 22	
V Carinæ	8 26.7	—59 47	7.4— 8.1	6 16.7	5 5		11 22		18 14		25 7	
T Velorum	8 34.4	—47 01	7.6— 8.5	4 15.3	3 9		12 16		17 7		26 13	
V Velorum	9 19.2	—55 32	7.5— 8.2	4 08.9			8 2		16 19		25 13	
Z Leonis	9 46.4	+27 22	7.9— 9.6	56 08.7					21 19			
RR Leonis	10 02.1	+24 29	9.1—10.1	0 10.9	5 12		12 6		19 2		25 21	
SU Draconis	11 32.2	+67 53	8.9— 9.6	0 15.8	1 11		8 1		21 6		27 20	
S Muscæ	12 07.4	—69 36	6.4— 7.3	9 15.8	5 9				15 1		24 17	
SW Draconis	12.8	+70 04	8.8— 9.6	0 13.7	6 16		14 15		22 15		30 14	
T Crucis	15.9	—61 44	6.8— 7.6	6 17.6	1 6		8 1		21 11		28 5	
R Crucis	18.1	—61 04	6.8— 7.9	5 19.8	5 18		11 13		23 5		29 1	
S Crucis	12 48.4	—57 53	6.5— 7.6	4 16.6	3 16		13 1		17 18		27 3	
W Virginis	13 20.9	— 2 52	8.7—10.4	17 06.5					17 12			
SS Hydræ	25.0	—23 08	7.4— 8.1	8 04.8	1 12		9 17		17 22		26 3	
RV Urs. Maj.	13 29.4	+54 31	9.2— 9.9	0 11.2	3 2		10 2		17 3		24 3	
ST Virginis	14 22.5	— 0 27	10.3—11.4	0 09.9	3 20		11 6		81 16		26 2	
V Centauri	25.4	—56 27	6.4— 7.8	5 11.9	4 13		10 1		21 1		26 12	
RS Bootis	29.3	+32 11	8.9—10.0	0 09.1	5 1		12 14		20 3		27 16	
R Trian.Austr.	15 10.8	—66 08	6.7— 7.4	3 09.3	2 2		8 21		22 10		29 5	
S Trian.Austr.	15 52.2	—63 29	6.4— 7.4	6 07.8	5 11		11 19		24 10		30 18	
S Normæ	16 10.6	—57 39	6.6— 7.6	9 18.1	6 12				16 6		26 1	
RW Draconis	33.7	+58 03	9.6—10.3	0 10.6	2 4		11 1		19 21		28 18	
RV Scorpii	16 51.8	—33 27	6.7— 7.4	6 01.5	3 15		9 16		21 19		27 21	
X Sagittarii	17 41.3	—27 48	4.4— 5.0	7 00.3	6 6		13 6		20 6		27 7	
Y Ophiuchi	47.3	— 6 07	6.1— 6.5	17 02.9	5 13				22 16			
W Sagittarii	17 58.6	—29 35	4.3— 5.1	7 14.3	2 0		9 15		17 5		24 19	
Y Sagittarii	18 15.5	—18 54	5.4— 6.2	5 18.6	1 20		13 9		19 3		30 17	
U Sagittarii	26.0	—19 12	6.5— 7.3	6 17.9	7 15		14 9		21 2		27 20	
Y Scuti	32.6	— 8 27	8.7— 9.2	10 08.3	7 5				17 13		27 21	
RZ Lyræ	39.9	+32 42	9.9—11.2	0 12.3	6 4		13 20		21 12		29 4	
RT Scuti	18 44.1	—10 30	9.1— 9.7	0 11.9	7 8		14 18		22 4		29 15	
κ Pavonis	18 46.6	—67 22	3.8— 5.2	9 02.2	5 4		14 7		23 9			
U Aquilæ	19 24.0	— 7 15	6.2— 6.9	7 00.6	6 3		13 4		20 4		27 [illegible]	
XZ Cygni	19 30.4	+56 10	8.6— 9.3	0 11.2	4 4		11 4		18 3		25 3	

Maxima of Variable Stars of Short Period—Continued.

Star	R.A. 1900	Decl. 1900	Magnitude	Approx. Period	Greenwich civil times of maxima in 1927 April							
	h m	° ′		d h	d h	d h	d h	d h	d h	d h	d h	d h
U Vulpec.	32.2	+20 07	6.5— 7.6	7 23.5	2 19	10 18	18 18	26 17				
SU Cygni	40.8	+29 01	6.2— 7.0	3 20.3	7 18	15 10	23 3	30 19				
η Aquilæ	47.4	+ 0 45	3.7— 4.5	7 04.2	4 3	11 7	18 11	25 16				
S Sagittæ	51.5	+16 22	5.6— 6.4	8 09.2	4 20	13 6	21 15	30 0				
X Vulpec.	19 53.3	+26 17	9.5—10.5	6 07.7	6 20	13 4	19 12	25 19				
X Cygni	20 39.5	+35 14	6.0— 7.0	16 09.3			16 5					
T Vulpec.	47.2	+27 52	5.5— 6.1	4 10.5		8 3	17 0	25 21				
UY Cygni	52.3	+30 03	9.6—10.4	0 13.5	1 1	8 8	22 22	30 5				
RV Capric.	55.9	—15 37	9.2—10.1	0 10.7	5 18	12 22	20 2	27 6				
TX Cygni	20 56.4	+42 12	8.5— 9.7	14 17.4		12 20		27 13				
VY Cygni	21 00.4	+39 34	8.8— 9.5	7 20.6	6 8	14 5	22 1	29 22				
SW Aquarii	10.2	— 0 20	9.9—10.8	0 11.0	2 8	9 6	23 0	29 22				
VZ Cygni	21 47.7	+42 40	8.2— 9.2	4 20.7		9 19	19 13	29 6				
Y Lacertæ	22 05.2	+50 33	9.1— 9.6	4 07.8	7 2	15 18		24 9				
δ Cephei	25.5	+57 54	3.7— 4.6	5 08.8	2 5	12 23	18 8	29 1				
Z Lacertæ	36.9	+56 18	8.2— 9.0	10 21.1	6 20		17 18	28 15				
RR Lacertæ	37.5	+55 55	8.5— 9.2	6 10.1	3 19	10 4	23 0	29 10				
V Lacertæ	44.5	+55 48	8.5— 9.5	4 23.6	3 12	13 11	23 11					
X Lacertæ	22 45.0	+55 54	8.2— 8.6	5 10.7	1 6	12 4	17 14	28 12				
SW Cassiop.	23 03.7	+58 11	9.2— 9.7	5 10.6	3 4	14 1	19 12	30 (				
RS Cassiop.	32.6	+61 52	9.0—11.0	6 07.1	6 13	12 20	19 3	25 10				
RY Cassiop.	47.2	+58 11	9.3—11.8	12 03.4	5 6		17 9	29 12				
V Cephei	23 51.7	+82 38	6.0— 7.0	0 23.9	3 0	10 0	23 23	30 23				

Monthly Report of the American Association of Variable Star Observers, for the Month ending January 31, 1927.

The recently adopted style of publication for our reports is meeting with much favorable comment, especially on the part of our more active observers. It certainly tends towards greater compactness, and is very easily handled by those who have occasion to consult our records.

Four new names are added to the list of observers for this month. Messrs. Carl F. Kurtz and Michael Ebert of Bethlehem, Pa., are working with a 6-inch refractor, Messrs. Goodrich Watkins of Caldwell, Idaho, and Walter H. Rowley, of West Wareham, Mass., are observing with 3-inch glasses. Mrs. Morris, of Nantucket, Mass., continues as our lone woman observer.

According to observations by Mr. Peltier, SS Cygni was on the increase to maximum on January 13, sixty-two days after the previous rise. RY Sagittarii continued to decrease and SU Tauri appears to be somewhat below normal maximum, and requires special attention.

Mr. D. B. Pickering leaves for Europe in February to complete the extensive tour which was cut short last year by illness. Again he will act as the official representative of the Association and he will report on his travels in a special series of articles written for Popular Astronomy. Mr. S. C. Hunter left early in January for an extended trip to South Africa where so many new southern stations are being erected. Secretary Olcott has gone to Useppa Isle, Florida, having spent the past two months sojourning in Camden, N. C.

The following observers have contributed to the results here presented: Messrs. Allen, "Al"; Baldwin, "Bl"; Bappu, "Bf"; Bhaskaran, "Bg"; Bouton, "B"; Brown, "Bn"; Bush, "Bu"; Chandler, "Cd"; Chandra, "Ch"; Cherrington,

VARIABLE STAR OBSERVATIONS RECEIVED DURING JANUARY, 1927.

Nov. 0 = J. D. 2424820; Dec. 0 = J. D. 2424850; Jan. 0 = J. D. 2424881.

J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.
S SCL	S CET	U TUC	S ARI	σ CET	R HOR
001032	*001909*	*005475*	015912	*021403*	*025050*
824 6.5 Sm	882[10.9 Lg	844 10.3 Sm	886 14.0 B	869 4.9 Ch	829 5.8 Bl
826 6.8 Ht	883[10.9 Lg	847 10.5 Bl	R ARI	871 5.0 Ch	840 5.8 Ht
826 6.0 Bl	884[10.9 Lg	848 9.9 En	021024	871 5.3 Ms	844 5.6 Ht
829 6.7 En	886[10.9 Lg	849 10.3 Sm	821 9.7 Wb	873 5.3 Ms	844 6.1 Sm
840 6.7 Ht	887[10.9 Lg	Z CET	830 9.4 Wb	876 5.2 Wa	848 5.9 En
844 7.0 Ht	888[10.9 Lg	*010102*	848 8.3 Ch	880 5.1 L	849 5.6 Ht
846 6.7 Sm	890[10.9 Lg	880 11.2 Pt	864 8.1 Ch	880 4.8 Pt	T HOR
847 6.5 Bl	892[10.9 Lg	887 11.7 B	874 8.8 Wk	880 5.4 Ms	*025751*
848 6.5 En	T PHE	U SCL	878 8.5 Lv	881 5.3 Bu	824 10.0 Sm
849 7.3 Ht	*002546*	*010630*	879 8.0 Wk	887 5.4 Bu	830 9.8 Bl
880 7.1 Pt	824 13.4 Sm	829 12.4 Bl	880 8.5 Pt	884 5.5 Ms	844 11.0 Sm
X AND	846 13.0 Sm	U AND	882 8.5 Lv	888 5.5 Eb	U ARI
001046	Y CEP	010940	886 8.8 R	888 5.5 Rw	030514
822 11.2 Bg	003179	880 12.2 B	886 8.5 Wb	889 5.6 Kz	822 14.4 Bg
828 12.2 Bf	889 12.9 B	888 12.2 Ie	887 9.7 Bu	897 5.5 Bu	828 14.8 Bf
832 11.7 Bg	U CAS	S PSC	889 8.6 Wk	898 6.0 Rw	832 14.7 Bg
838 12.0 Bg	004047	011208	W AND	S PER	843 14.8 Bg
844 12.0 Bg	880 14.1 Pt	886 12.2 B	021143a	021558	846 14.6 Bg
847 12.3 Bg	882 13.1 Lv	S CAS	858 11.6 Ch	849 8.4 B	849 14.7 Bg
849 12.1 Bg	887 12.6 B	011272	880 11.5 Pt	880 8.4 Pt	X CET
880 13.3 B	888 13.0 Ie	853 8.9 Ch	886 10.0 B	R CET	*031401*
882 12.3 Lv	V AND	880 8.2 Pt	T PER	022000	869 9.0 L
T CET	004435	889 9.0 B	021258	844 8.5 B	880 8.9 L
001620	822 15.1 Bg	U PSC	849 8.7 B	880 7.9 Ya	880 8.6 Pt
859 5.5 L	832 15.0 Bg	011712	880 8.6 Pt	R FOR	880 9.5 Jo
T AND	843 15.0 Bg	880 11.5 Pt	Z CEP	*022426*	880 8.8 Ya
001726	844 15.2 Bg	RZ PER	021281	829 8.5 Bl	887 8.9 B
853 10.8 Ch	847 15.2 Bg	012350	880 11.3 Pt	847 8.5 Bl	Y PER
878 13.2 Lv	849 15.2 Bg	887 10.2 B	o CET	U CET	032043
884 12.2 Lv	880 13.7 B	R PSC	*021403*	022813	793 8.8 Gb
885 12.2 B	882 13.5 Lv	012502	792 3.8 H	880 10.8 Pt	880 9.8 Ya
T CAS	RR AND	822 13.4 Bg	793 3.6 H	RR CEP	880 9.2 Pt
001755	004533	828 13.5 Bf	794 3.5 Wk	022980	R PER
869 9.6 L	822 14.4 Bg	832 13.3 Bg	797 3.4 Wk	880 11.5 Pt	032335
871 10.0 Ch	828 14.4 Bf	843 12.7 Bg	799 3.4 H	R TRI	879[13.2 Ie
880 9.7 Jo	832 15.0 Bg	847 12.5 Bg	801 3.5 H	023133	R TAU
880 8.9 L	843 15.0 Bg	850 12.4 Bg	803 3.2 H	848 11.6 Ch	042209
880 10.0 Pt	844 14.9 Bg	878 11.0 Lv	813 3.4 H	858 11.0 Ch	822 14.2 Bf
R AND	847 14.8 Bg	880 10.4 Pt	819 3.2 H	880 9.0 Pt	829 14.2 Bg
001838	849 15.0 Bg	RU AND	821 3.2 En	880 9.0 Ya	833 14.4 Bg
880 13.6 B	RV CAS	013238	823 3.6 Sm	882 9.3 Lv	843 13.8 Bg
880 13.3 Pt	004746a	880 13.3 Pt	826 3.6 En	891 8.9 Ie	846 13.8 Bg
S TUC	888[13.2 Ie	Y AND	828 3.6 Sm	W PER	849 13.3 Bg
001862	— CAS	013338	829 3.7 Wk	024356	880 9.8 Pt
824 10.0 Sm	004746b	880[13.7 B	837 4.0 Ch	854 9.2 Mj	W TAU
826 10.1 Bl	880 10.6 Pt	X CAS	840 3.8 En	856 9.2 Mj	042215
844 10.4 Sm	888 10.6 Ie	014958	842 4.2 En	859 9.2 Mj	854 10.2 Mj
847 10.4 Bl	W CAS	858 11.5 Bn	843 4.4 Ch	878 9.2 B	856 10.0 Mj
849 10.9 Sm	004958	871 11.5 Bn	844 4.0 Sm	879 8.9 Cl	859 9.9 Mj
S CET	878 10.4 B	878 10.4 B	846 4.3 Ch	880 9.0 Ya	871 9.5 B
001909	880 11.1 Pt	880 10.5 Pt	846 4.3 En	880 9.0 Pt	872 9.8 Jo
865[10.9 Lg	889 10.4 B	885 11.1 Bn	848 4.0 Sm	888 9.4 Kz	880 9.4 Jo
866[10.9 Lg	U TUC	889 10.4 B	849 4.5 Ch	888 9.6 Eb	880 9.5 Pt
867[10.9 Lg	*005475*	U PER	852 4.8 Ch	R HOR	885 9.6 B
871[10.9 Lg	821 11.8 En	015254	854 4.3 Mj	*025050*	S TAU
878[10.9 Lg	824 11.6 Sm	880 10.2 Pt	858 4.8 Ch	821 6.7 En	042309
880[10.9 Lg	826 11.5 En	887 10.0 B	859 4.6 Mj	824 6.7 Sm	829 15.1 Bf
880[14.2 L	826 11.3 Bl		860 4.8 L	826 7.1 En	846 15.1 Bg
881[10.9 Lg	829 11.4 En		861 4.8 Ch	826 6.1 Ht	849 15.3 Bg

VARIABLE STAR OBSERVATIONS RECEIVED DURING JANUARY, 1927—Continued.

J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.
T CAM	V ORI	S ORI	SU TAU	Z AUR	Y MON
043065	050003	*052404*	054319	055353	065111
871 12.6 L	880 12.3 Pt	880 9.3 Pt	882 10.0 Lv	887 10.0 Pt	885 12.2 B
880 12.9 Pt	887 12.3 B	892 9.1 B	884 10.1 Pt	892 10.0 Pt	X MON
881 13.1 L	T LEP	T ORI	887 10.2 Pt	892 9.6 Pt	*065208*
X TAU	*050022*	*053005a*	892 10.4 Pt	898 9.7 Pt	848 7.9 Ch
043208	830 10.9 Bl	869 11.3 L	S COL	R OCT	880 8.1 L
882 9.2 Lv	878 8.5 B	873 11.4 Pt	*054331*	*055686*	881 9.2 Bu
887 9.2 B	880 9.0 Pt	875 10.7 B	824 12.9 Sm	848[11.6 Sm	891 8.9 Cb
R RET	892 8.6 B	876 10.0 Pt	829 12.6 En	X AUR	V CMI
043263	S PIC	879 10.1 Pt	844 13.0 Ht	060450	070109
821[12.2 Sm	*050848*	879 10.9 Ie	844 12.2 Sm	845 11.2 Ch	846 10.8 Ch
824 12.3 Sm	828[12.9 Sm	880 10.2 L	848 12.3 En	848 11.2 Ch	885 12.2 B
826 12.4 Ht	844[12.9 Sm	880 9.8 Pt	849 12.3 Ht	851 11.1 Ch	R GEM
844 12.5 Sm	847[12.2 En	882 10.0 Pt	849 12.2 Sm	854 10.8 Ch	070122a
848 12.2 En	849[12.9 Sm	884 10.0 Pt	Z TAU	861 10.4 Ch	846 7.6 Ch
849[12.2 Ht	R AUR	887 10.0 Pt	054615a	879 9.6 Ie	858 7.4 Ch
X CAM	050953	887 10.5 B	833 13.8 Bg	880 9.4 Pt	877 7.2 B
043274	848 8.8 B	892 9.9 Pt	847 13.9 Bg	V AUR	880 6.9 Pt
847 9.7 Ch	876 9.3 Wa	896 10.0 Pt	850 14.0 Bg	061647	880 7.0 Al
880 10.5 Pt	880 9.5 Pt	898 10.3 Pt	877 14.0 Ie	880 12.1 B	887 7.3 B
R DOR	T PIC	S CAM	RU TAU	V MON	888 7.5 Al
043562	*051247*	053068	054615c	061702	890 7.7 Kz
821 5.8 En	821 8.6 En	797 8.6 Wk	833 12.3 Bg	848 7.8 Ch	890 7.7 Eb
824 5.4 Sm	826 8.6 En	803 8.7 Wk	847 10.7 Bg	880 6.9 Pt	891 7.1 Eb
826 5.7 En	826 8.3 Ht	829 8.9 Wk	850 10.7 Bg	880 6.8 Bu	Z GEM
826 5.6 Ht	828 8.4 Sm	834 9.8 Wk	877 10.8 Ie	887 7.0 Bu	070122b
829 5.6 En	830 7.8 Bl	858 10.4 Wk	R COL	R MON	877 12.8 B
840 5.2 Ht	840 8.4 Ht	879 10.9 Wk	*054629*	063308	880 12.5 Ft
844 5.5 Ht	844 8.6 Ht	880 10.5 Pt	826[12.4 Ht	880 10.8 Pt	887 12.3 B
844 5.5 Sm	844 8.8 Sm	888 10.7 Wk	844[12.4 Sm	885 11.7 B	TW GEM
848 5.3 En	847 8.7 En	RR TAU	848[12.0 En	Nov. PIC	070122c
849 5.5 Ht	849 8.6 Ht	053326	849[13.0 Sm	*063462*	877 8.1 B
849 5.2 Sm	849 8.4 Sm	822 10.9 Bf	849[12.4 Ht	824 6.2 Sm	880 7.9 Pt
R CAE	T COL	833 10.7 Bg	U ORI	826 6.2 Ht	887 8.1 B
043738	*051533*	847 11.9 Bg	054920a	828 6.2 Sm	R CMI
826 12.3 Ht	826 8.5 Ht	850 11.0 Bg	793 6.0 Bg	840 6.0 Ht	070310
830 12.2 Bl	826 8.4 En	880 12.5 B	845 8.5 Ch	844 6.2 Ht	846 8.3 Ch
844[12.0 Sm	830 8.7 Bl	RU AUR	859 8.9 Ch	844 6.3 Sm	880 8.4 L
849[12.0 Ht	840 9.2 Ht	053337	872 8.9 Jo	846 6.3 Sm	880 8.8 Wa
R PIC	844 9.7 Ht	880 11.0 Pt	876 8.9 Wa	848 6.3 Sm	881 8.7 B
044349	844 9.2 Sm	U AUR	880 9.4 Al	849 6.3 En	R VOL
830 7.8 Bl	848 9.7 En	053531	880 9.2 B	849 6.2 Ht	*070772*
R ORI	849 10.2 Sm	848 8.6 Ch	880 9.2 Jo	S LYN	824[12.6 Sm
045307	849 9.7 Ht	871 9.2 B	880 9.0 Pt	063558	826[12.6 Ht
892 11.3 B	S AUR	880 8.7 Pt	880 9.1 Cb	871[13.0 B	844[12.6 Ht
R LEP	052034	885 9.8 B	889 9.4 Kz	880 13.4 Pt	846[12.2 Sm
045514	848 9.8 Ch	SU TAU	889 9.5 Eb	885 13.7 B	848[12.6 En
819 9.8 Wb	871 9.3 B	054319	Z AUR	X GEM	849 13.0 Ht
830 9.6 Wb	876 9.0 Wa	845 9.8 Ch	055353	064030	V GEM
846 10.3 Ch	880 8.6 Pt	850 9.8 Ch	848 10.6 Ch	858 12.8 Bn	071713
860 10.2 Ch	885 9.4 B	854 9.8 Ch	854 10.9 Mj	875 13.3 B	880 10.5 Pt
880 8.8 L	W AUR	859 9.8 Ch	856 10.8 Mj	879 13.3 Bn	882 10.9 B
880 8.6 Pt	052036	859 10.8 L	859 10.9 Mj	885 13.0 Bn	S CMI
881 9.5 Bu	848 10.6 Ch	869 10.4 L	871 10.6 B	887 13.5 B	*072708*
886 9.3 Wb	871 11.1 B	873 10.1 Pt	873 10.6 Pt	W MON	840 9.5 Ch
887 9.6 B	879 12.2 Ie	876 9.6 Pt	876 10.4 Pt	*064707*	850 8.7 Ch
890 9.4 Al	880 11.7 Pt	877 10.2 Ie	879 10.8 Pt	880 10.2 Pt	858 8.2 Ch
897 9.3 Bu	885 12.2 B	879 9.9 Pt	880 10.6 Pt	885 10.3 B	861 8.1 Ch
V ORI	S ORI	880 10.2 Pt	882 10.6 Pt	Y MON	866 8.0 Ch
050003	*052404*	880 10.3 L	884 10.2 Pt	065111	872 7.8 Jo
875 12.4 B	878 9.5 B	882 10.1 Pt	885 10.4 B	880 12.5 Pt	880 7.5 Jo

VARIABLE STAR OBSERVATIONS RECEIVED DURING JANUARY, 1927—Continued.

J.D.Est.Obs.

S CMI
072708
880 7.1 Wa
880 7.4 L
880 7.5 Pt
881 7.6 B
888 8.0 Al

T CMI
072811
880 12.6 B

U CMI
073508
880 12.5 B
880 12.9 L
887 12.4 Pt

S GEM
073723
840 9.2 Ch
847 9.3 Ch
849 9.2 Ch
851 9.2 Ch
854 9.3 Ch
859 9.4 Ch
861 9.6 Ch
865 9.8 Ch
878 10.4 B
879 10.6 Ie
880 10.7 Wa
887 11.0 Pt
892 8 8 B

W PUP
074241
824 9.4 Sm
826 9.4 Ht
840 8.3 Ht
844 8.5 Ht
844 8.5 Sm
849 8.5 Sm
849 9.4 Sm

T GEM
074323
840 8.7 Ch
847 8.8 Ch
849 8.8 Ch
851 8.8 Ch
854 8.9 Ch
859 9.0 Ch
861 9 0 Ch
865 9.1 Ch
877 9.0 B
887 9.2 B
887 9.2 Pt

U PUP
075612
860 10.0 Ch
885 10.1 B

R CNC
081112
859 11.1 Ch
880 10.4 L
887 10.1 Pt

J.D.Est.Obs.

V CNC
081617
887 12.5 B
887 12.8 Pt

RT HYA
082405
887 7.9 Pt

R CHA
082476
829[12.4 En
844[12.4 Sm
848[12.4 En

U CNC
083019
887 13.7 B

S HYA
084803
885 11.9 B
887 12.0 Pt

T HYA
085008
859 10.7 Ch
885 9.9 B
887 10.1 Pt

T CNC
085120
852 9.5 Ch
887 8.6 Pt

W CNC
090425
880[11.4 Wa

Y VEL
092551
844 9.8 Sm
849 9.8 Sm

R CAR
092962
826 8.1 Ht
840 8.4 Ht
844 8.5 Sm
848 8.4 En
849 8.5 Sm
849 8.9 Ht

X HYA
093014
826 8.0 Bf
860 8.5 Ch
887 9.3 Pt

R LMI
093934
887 12.3 Pt
888 10.5 Al

R LEO
094211
854 6.0 Ch
871 5 7 Ch
878 6.0 Wb
880 5.5 Wa
887 6.0 Wb
887 5.8 Pt
888 5.5 Al
890 6.0 Eb

J.D.Est.Obs.

R LEO
094211
890 5.9 Kz

Y HYA
094622
887 6.2 Pt

Z VEL
094953
840[12.1 Ht
844[12.1 Sm
849[12.1 Ht

V LEO
095421
860[11.9 Ch
887 11.6 Pt

RY LEO
095814
881 8.6 Kl

S CAR
100661
840 9.5 Ht
844 9.1 Sm
849 8.6 Sm
849 9.3 Ht

U HYA
103212
881 4.7 L

R UMA
103769
854 9 9 Ch
887 11.2 Pt

V HYA
104620
854 9.2 Ch
881 8.4 L
887 8.5 Pt

W LEO
104814
826 14.1 Bf

S LEO
110506
887 13.0 Pt

T VIR
120905
887 13.6 Pt

R CRV
121418
826 11.8 Bf
887 13.5 Pt

SS VIR
122001
881 7.3 L

T CVN
122532
887 11.5 Pt

Y VIR
122803
826 10.0 Bf
881 10.4 L

T UMA
123160
822 8.7 Wb

J.D.Est.Obs.

T UMA
123160
862 6.8 Kl
879 7.7 Kl
881 7.7 Kl
887 8.2 Pt
888 8.2 Al
889 7.7 Wk

R VIR
123307
881 10.9 L
887 11.0 Pt

RS UMA
123459
887 9.5 Pt
826 12.2 Bf
854[10.9 Ch
887 14.5 Pt

S UMA
123961
862 10.4 Kl
871 9.2 L
873 9.7 Kl
879 9.5 Kl
880 8.6 L
881 9.2 Kl
887 8.6 Pt
888 9.5 Al
889 9.0 Wk

RU VIR
124204
887 12.6 Pt

U VIR
124606
887 8.7 Pt

U OCT
131283
824 12 9 Sm
826 12.9 Ht
844 12 6 Ht
848 12.0 Sm
849 12.2 Ht

R HYA
132422
861 8.2 Ch
887 8.5 Pt

S VIR
132706
887 11.9 Pt

R CVN
134440
887 10.0 Pt

T APS
134677
828[12.3 Sm

RR VIR
135908
887 12.0 Pt

R CEN
140959
821 5.4 En
825 5.6 Bl
826 5.4 En

J.D.Est.Obs.

U UMI
141567
861 8.2 Ch
886 8.9 Pt

S BOO
141954
854 11.4 Ch
881 9.3 L
887 8.6 Pt

V BOO
142539a
881 9.2 L
886 9 0 Gb
887 9.5 Pt

R BOO
143227
854 8 0 Ch
887 8.8 Pt

S APS
145071
821 10.2 En
824 10.0 Sm
825 9.8 Bl
826 9.9 En
828 10.0 Sm
841 9.7 En
846 10.0 Bl

RT LIB
150018
887 10.0 Pt

S LIB
151520
887 9.0 Pt

S SER
151714
887 12.0 Pt

S CRB
151731
854 7.0 Ch
887 7.2 Pt

R NOR
152849
825 8.4 Bl

S UMI
153378
845 9.4 Ch
854 8.8 Mj
856 8.8 Mj
887 8.4 Pt

R CRB
154428
854 6.1 Ch
881 6.0 L
886 6.5 Gb
887 6.1 Pt
887 6.1 Ms
894 6.2 Pt
895 6.1 Pt

X CRB
154536
887 8.5 Pt

J.D.Est.Obs.

R SER
154615
861 9.8 Ch
887 7.5 Pt

V CRB
154639
887 8.7 Pt

RZ SCO
155823
887 8.6 Pt

U SER
160210
887 11.8 Pt

SX HER
160325
887 8.0 Pt
894 8.0 Pt
895 8.0 Pt

RU HER
160625
887 12 8 Pt

S SCO
161122b
887 11.7 Pt

W CRB
161138
887 8.2 Pt

V OPH
162112
887 8.2 Pt

U HER
162119
887 11.3 Pt

SS HER
162807
887 12 0 Pt

W HER
163137
846 8.4 Ch
861 8.0 Ch
887 8.5 Pt

R DRA
163266
845 6.7 Ch
887 8.0 Pt
889 8.2 Wk

RR OPH
164319
826[10.8 En

S HER
164715
887 8.1 Pt

RS SCO
164841
821 10.4 En
824 10.0 Sm
825 9.6 Bl
826 10.3 En
828 10.0 Sm

RR SCO
165037
825 8.1 Bl

VARIABLE STAR OBSERVATIONS RECEIVED DURING JANUARY, 1927—Continued.

J.D.	Est.	Obs.
SS OPH		
165202		
887	8.6	Pt
RT HER		
170627		
887	12.1	Pt
Z OPH		
171401		
887	8.8	Pt
RS HER		
171723		
887	9.9	Pt
S OCT		
172486		
826	13.2	Ht
844	13.0	Ht
828[	12.8	Sm
849	13.0	Ht
RU OPH		
172809		
887	9.5	Pt
RU SCO		
173543		
825	9.4	Bl
846	10.0	Bl
W PAV		
174162		
821	9.7	En
824	9.9	Sm
825	9.7	Bl
826	9.9	Ht
826	9.9	En
829	9.9	En
840	10.1	Ht
841	10.1	En
844	9.9	Sm
844	10.4	Ht
847	10.2	Bl
848	10.2	En
U ARA		
174551		
821	11.3	En
824	11.7	Sm
826	11.5	En
841	12.5	En
844[	12.3	Sm
848[	12.3	En
T DRA		
175458a		
873	12.3	Cd
UY DRA		
175458b		
873	11.1	Cd
RY HER		
175519		
845	9.3	Ch
858	9.6	Ch
876	9.7	Pt
R PAV		
180363		
821	10.7	En
824	11.1	Sm
826	10.8	En
826	11.0	Ht
829	11.4	En
840	11.9	Ht
841	11.6	En
844	11.9	Sm
844	12.2	Ht
848	12.0	En
849	12.1	Sm
T HER		
180531		
845	7.0	Ch
867	8.1	L
873	8.5	Pt
880	8.8	L
W DRA		
180565		
873	12.0	Pt
877	13.2	Cd
X DRA		
180666		
876	11.5	Pt
877	10.9	Cd
TV HER		
181031		
869	9.4	L
880	9.7	L
RY OPH		
181103		
894	8.0	Pt
W LYR		
181136		
859	9.7	L
870	10.2	L
873	12.0	Pt
881	11.8	L
RV SGR		
182133		
825	8.5	Bl
847	7.9	Bl
SV HER		
182224		
869	9.4	L
873	9.7	Pt
880	9.9	L
T SER		
182306		
894	12.3	Pt
X OPH		
183308		
858	6.7	L
869	7.2	L
880	7.1	L
894	7.8	Pt
RV LYR		
184134		
873	11.4	Pt
R SCT		
184205		
760	6.5	H
763	5.9	H
766	6.0	H
767	5.9	H
770	5.4	H
771	5.3	H
776	5.8	H
778	5.6	H
784	5.8	H
785	5.5	H
786	5.9	H
789	5.8	H
791	5.8	H
792	5.8	H
798	5.8	H
800	5.9	H
801	5.9	H
805	5.9	H
807	6.0	H
809	6.0	H
811	6.0	H
812	6.0	H
817	5.9	H
818	6.0	H
819	5.9	H
843	5.6	Ch
858	6.0	L
869	6.4	L
NOV AQL		
184300		
846	10.4	Ch
RX LYR		
185032		
846[	11.5	Ch
ST SGR		
185512a		
846[	11.2	Ch
RT LYR		
185737		
846[	11.1	Ch
R AQL		
190108		
843	7.4	Ch
873	8.7	Pt
RX SGR		
190818		
843[	11.1	Ch
RW SGR		
190819a		
843	11.0	Ch
X LYR		
190926		
873	9.1	Pt
RS LYR		
190933a		
846	9.0	Ch
873	11.1	Pt
RU LYR		
190941		
873	11.4	Pt
U DRA		
190967		
873	13.2	Pt
W AQL		
191007		
846	9.0	Ch
T SGR		
191017		
843	11.0	Ch
R SGR		
191019		
843	7.0	Ch
RY SGR		
191033		
822	6.7	Bf
824	6.5	Sm
825	6.6	Bl
826	6.3	En
826	6.6	Bf
826	6.5	Ht
828	6.9	Sm
829	6.5	Ht
840	7.7	Ht
841	7.7	En
844	8.5	Ht
844	8.1	Sm
847	9.0	Bl
848	9.2	Sm
848	9.1	En
849	9.2	Bf
850	9.4	Bf
TY SGR		
191124		
825	11.8	Bl
S SGR		
191319a		
825	11.5	Bl
847	11.8	Bl
TZ CYG		
191350		
873	11.1	Pt
U LYR		
191637		
876	9.1	Pt
RT AQL		
193311		
876	10.1	Pt
R CYG		
193449		
843	8.8	Ch
861	7.1	Ch
872	7.3	Jo
873	7.0	Ms
876	7.5	Cb
876	7.0	Pt
880	6.9	Jo
891	7.0	Ie
T PAV		
193972		
821	10.0	En
824	10.2	Sm
826	10.4	Bl
826	10.5	Ht
826	10.7	En
829	10.8	En
840	11.2	Ht
841	11.5	En
844	12.1	Ht
844	11.5	Sm
847	12.1	Bl
848	11.7	En
849	12.1	Ht
849	11.6	Sm
RT CYG		
194048		
843	9.1	Ch
852	9.4	Ch
858	9.9	Ch
861	10.0	Ch
876	11.4	Pt
879	11.1	Cd
803	8.2	Wb
TU CYG		
194348		
876	13.5	Pt
X AQL		
194604		
876	8.5	Pt
χ CYG		
194632		
843	10.2	Ch
848	9.3	Ch
851	9.1	Ch
859	7.9	L
860	8.7	Ch
864	8.6	Ch
867	8.4	Ch
871	8.0	Ch
876	7.8	Pt
880	7.7	L
RR SGR		
194929		
826	8.8	Bl
847	9.8	Bl
RU SGR		
195142		
824	10.9	Sm
826	10.5	Ht
826	10.4	Bl
826	10.8	En
840	9.1	Ht
841	9.7	En
844	9.2	Ht
844	9.2	Sm
847	9.3	Bl
848	9.3	En
849	8.8	Ht
849	8.8	Sm
NOV CYG		
195553		
876	13.4	Pt
887	12.2	Pt
894	12.2	Pt
Z CYG		
195849		
852	11.4	Ch
875	12.5	B
876	11.0	Pt
SY AQL		
200212		
869	11.0	L
876	11.0	Pt
880	10.3	L
R CAP		
200514		
861	9.9	Ch
876	9.5	Pt
S AQL		
200715a		
843	10.7	Ch
872	11.5	Lg
881	11.7	Lg
878	11.7	Lg
RW AQL		
200715b		
865	9.1	Lg
866	9.2	Lg
867	9.1	Lg
872	8.9	Lg
876	9.1	Pt
878	9.1	Lg
881	8.9	Lg
Z AQL		
200906		
876	10.5	Pt
RS CYG		
200938		
843	8.3	Ch
844	8.0	Ch
848	8.4	Ch
849	8.5	Ch
849	7.8	Gb
850	8.5	Ch
851	8.4	Ch
853	8.2	Ch
858	8.6	Ch
860	8.6	Ch
861	8.6	Ch
862	8.6	Ch
864	8.6	Ch
865	8.6	Ch
866	8.6	Ch
869	8.6	Ch
869	8.0	L
872	8.6	Jo
876	8.2	Pt
876	9.3	Cb
880	8.7	Jo
880	8.1	L
805	7.4	Wb

VARIABLE STAR OBSERVATIONS RECEIVED DURING JANUARY, 1927—Continued.

J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.
R DEL	SZ CYG	T CEP	RU CYG	RS PEG	RW PEG
201008	202946	210868	213753	220714	225914
869 12.2 L	898 9.5 Pt	792 7.0 H	848 8.4 Ch	828 13.2 Bf	876 10.4 Wa
871 11.6 B	ST CYG	798 7.3 H	876 8.3 Pt	832 13.5 Bg	879 10.5 Wa
876 11.2 Pt	202954	800 7.0 H	RV CYG	837 13.3 Bg	879 10.7 Cl
880 11.0 L	875 12.1 B	801 7.3 H	213937	843 13.1 Bg	885 10.6 B
SX CYG	876 12.4 Pt	803 7.3 H	876 6.5 Pt	847 13.1 Bg	891 11.4 Ie
201130	V VUL	803 6.4 H	RR PEG	849 13.0 Bg	893 11.3 Cl
875 11.9 B	203226	805 6.4 H	214024	876 12.5 Pt	R PEG
876 12.0 Pt	876 8.8 Pt	807 7.7 H	876 14.0 Pt	880 11.9 B	230110
P CYG	S DEL	811 7.7 H	R GRU	T GRU	873 12.5 Cd
201437a	203816	812 7.8 H	*214247*	*221938*	876 12.8 Pt
763 5.8 H	876 12.7 Pt	819 8.1 H	821 12.4 En	824 9.8 Sm	883 11.1 Lg
766 5.6 H	V CYG	821 7.9 Wb	824 12.4 Sm	844 8.9 Sm	884 11.0 Lg
767 5.6 H	203847	832 8.1 Wk	826 12.6 Ht	849 8.7 Sm	886 11.0 Lg
770 5.4 H	876 12.7 Pt	843 8.8 Ch	826 12.3 Bl	S GRU	887 11.0 Lg
771 5.4 H	Y AQR	856 9.3 Wb	826 12.4 En	*221948*	888 11.0 Lg
776 5.3 H	203905	858 9.8 Wk	829 12.5 En	824 12.6 Sm	890 11.0 Lg
778 5.2 H	876 12.8 Pt	858 9.3 Ch	844 12.9 Ht	826 13.1 Ht	V CAS
784 5.4 H	V AQR	859 8.8 L	844 12.9 Sm	844 12.4 Ht	230759
785 5.3 H	204102	870 9.2 B	849 13.3 Sm	844 12.3 Sm	871 9.2 B
786 5.3 H	853 9.1 Ch	871 9.5 Ch	V PEG	848 12.6 En	876 9.1 Pt
789 5.4 H	876 8.7 Pt	871 9.2 L	215605	849 12.4 Ht	885 8.6 B
791 5.4 H	W AQR	872 8.7 Jo	870 8.8 B	849 12.2 Sm	W PEG
792 5.3 H	*204104*	874 9.8 Wk	876 8.6 Pt	RV PEG	231425
798 5.3 H	871 13.7 L	876 9.0 Pt	U AQR	222129	851 9.3 Ch
800 5.4 H	880 13.9 L	879 10.1 Wk	*215717*	870 9.1 B	862 9.6 Kl
801 5.3 H	T AQR	881 9.9 L	876 11.9 Pt	885 9.9 B	873 9.8 Kl
803 5.4 H	*204405*	880 9.2 Jo	RT PEG	S LAC	879 10.3 Kl
805 5.3 H	843 9.5 Ch	882 9.6 B	215934	*222439*	880 10.3 Lg
807 5.3 H	853 10.0 Ch	888 10.2 Wk	852 11.5 Ch	852 9.0 Ch	881 10.3 Kl
809 5.2 H	876 11.5 Pt	RR AQR	876 11.9 Pt	870 7.9 B	882 9.7 Lv
WX CYG	RZ CYG	*210903*	878 12.1 B	876 7.8 Pt	882 10.4 Lg
201437b	204846	876 13.5 Pt	884 11.9 Lv	882 7.9 B	883 10.3 Lg
844 10.6 Ch	876 11.5 Pt	X PEG	889 11.6 B	884 7.9 Lv	884 10.4 Lg
853 10.6 Ch	R VUL	211614	RV PEG	891 8.0 Ie	887 10.5 Lg
876 9.7 Pt	205923	876 14.1 Pt	220133a	T TUC	S PEG
893 10.5 Ie	843 8.7 Ch	880 14.0 B	875 12.5 B	*223462*	231508
U CYG	876 11.8 Pt	T CAP	876 12.5 Pt	821 11.1 En	851 9.0 Ch
201647	TW CYG	*211615*	887 12.2 B	824 10.9 Sm	876 9.6 Pt
843 9.3 Ch	210129	862[10.3 Ch	RZ PEG	826 11.0 En	882 10.7 B
865 8.1 Ch	875 12.5 B	S MIC	220133b	826 11.1 Ht	V PHE
872 7.9 Io	879 12.5 Ie	*212030*	875 11.8 B	844 10.4 Ht	*233746*
876 8.1 Pt	RS AQR	824 8.9 Sm	876 12.0 Pt	844 9.6 Sm	824 12.7 Sm
878 7.9 B	*210504*	826 9.1 Bl	887 12.1 B	848 9.5 En	826 12.1 En
880 7.9 B	859[12.5 L	844 10.0 Sm	T PEG	849 10.2 Ht	826 12.2 Ht
U MIC	871[13.3 L	847 9.9 Bl	220412	849 9.4 Sm	844 11.8 Ht
202240	880[13.3 L	849 10.3 Sm	882 12.6 B	R LAC	846 10.8 Sm
826 10.4 Bl	T CEP	Y CAP	Y PEG	223841	848 10.8 En
847 11.4 Bl	210868	*212814*	220613	884[13.4 Lv	849 10.7 Ht
Z DEL	763 6.4 H	861[10.2 Ch	RW PEG	Z AND	
202817	766 6.5 H	W CYG	822 10.9 Bg	225914	232848
881[12.0 B	767 6.6 H	213244	828 10.4 Bf	822 10.8 Bg	850 9.1 Ch
SZ CYG	770 6.5 H	869 5.9 L	832 10.6 Bg	826 10.8 Bg	854 9.7 Mj
202946	771 6.6 H	880 5.8 L	837 10.6 Bg	829 10.7 Bg	856 9.8 Mj
873 8.7 Pt	776 6.7 H	S CEP	843 11.4 Bg	832 10.8 Bg	859 9.5 Mj
876 9.0 Pt	778 6.6 H	213678	847 11.3 Bg	837 10.5 Bg	876 9.6 Pt
884 9.2 Pt	784 6.6 H	859 8.8 Ch	849 11.4 Bg	ST AND	
887 8.7 Pt	785 6.6 H	870 8.6 B	876 13.2 Pt	843 10.6 Bg	233335
892 9.1 Pt	786 6.7 H	876 8.2 Pt	880 13.7 B	847 10.6 Bg	850 9.9 Ch
894 9.7 Pt	789 6.8 H	882 9.2 B	RS PEG	850 10.5 Bg	865 9.5 Lg
896 9.7 Pt	791 7.0 H		220714	870 10.1 B	866 10.6 Lg
			822 13.7 Bg	876 10.7 Pt	

VARIABLE STAR OBSERVATIONS RECEIVED DURING JANUARY, 1927—Continued.

J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.
ST AND	ST AND	R AQR	RR CAS	R TUC	Y CAS
233335	233335	233815	235053	235265	235855
867 10.6 Lg	884 10.5 Lg	880 8.9 Lg	868 11.6 Bn	849 10.8 Sm	878 12.1 B
871 10.6 Lg	887 10.6 Lg	882 8.9 Lg	878 11.3 B	R CAS	889 12.9 B
876 9.5 Wa	888 10.6 Lg	883 9.0 Lg	879 11.3 Bn	235350	SV AND
876 10.1 Pt	889 9.9 B	884 9.0 Lg	885 11.2 Bn	878 10.6 B	235939
878 10.6 Lg	890 10.6 Lg	886 8.9 Lg	889 11.4 B	884 11.4 Lv	859 10.1 Lv
878 9.8 B	R AQR	887 8.9 Lg	R TUC	889 10.8 B	876 10.5 Pt
879 10.5 Lg	233815	890 9.0 Lg	235265	Z PEG	878 10.6 Lv
880 10.6 Lg	843 9.5 Ch	Z CAS	824 13.5 Sm	235525	881 10.2 B
881 10.5 Lg	853 8.8 Ch	233956	829 12.9 En	876 11.3 Pt	884 10.5 Lv
882 10.5 Lg	876 8.6 Pt	884 13.2 Lv	844 10.8 Sm		896 10.4 B
883 10.6 Lg	878 8.9 Lg		848 10.6 En		

RAPIDLY VARYING IRREGULAR VARIABLES.

Star J.D. Est.Obs.	J.D. Est.Obs.	Star J.D. Est.Obs.	J.D. Est.Obs.
005840 RX ANDROMEDAE—		213843 SS CYGNI—	
4876.6 12.6 Pt	4884.5[10.9 Pt	4763.9 8.3 H	4874.5 11.7 B
4879.8[11.7 Pt	4887.5 12.0 Pt	4793.7 11.0 Gb	4875.6 11.7 B
4880.5[12.4 Pt	4892.5[11.7 Pt	4837.2 8.6 Ch	4876.6 11.5 Pt
060547 SS AURIGAE—		4838.2 8.6 Ch	4876.6 11.9 Wa
4858.2[13.5 L	4877.5 13.8 Ie	4839.2 8.6 Ch	4877.5 11.7 B
4859.3[12.4 L	4877.5 13.3 Cd	4840.2 8.5 Ch	4877.5 11.6 Ie
4869.3 10.6 L	4877.6 13.4 B	4843.1 8.5 Ch	4878.5 11.8 B
4870.3 10.5 L	4878.5 13.8 B	4844.1 8.7 Ch	4879.5 11.7 Ie
4871.2 10.6 L	4879.5[13.3 Ie	4845.2 8.8 Ch	4879.6 11.6 Cl
4871.5 10.7 B	4880.3 14.5 L	4846.0 9.0 Ch	4880.2 11.8 L
4872.5 10.8 Cd	4880.6 14.0 B	4847.2 9.5 Ch	4880.5 11.9 B
4872.6 11.0 Cl	4882.6[12.6 Pt	4848.2 9.6 Ch	4881.2 11.8 L
4873.5 11.0 Pt	4882.6[13.9 B	4849.1 9.8 Ch	4881.5 11.9 B
4874.5 11.6 B	4884.5[12.6 Pt	4850.1 10.7 Ch	4882.5 11.7 B
4875.6 12.1 B	4887.5[12.6 Pt	4851.1 11.0 Ch	4884.5 11.9 Lv
4875.6 12.2 Cd	4892.5[12.4 Pt	4852.1 11.5 Ch	4884.5 11.7 Pt
4876.6 13.2 Pt	4893.5[12.0 Cl	4852.1 11.5 Ch	4885.5 11.7 B
4876.6[11.6 Wa	4894.9[12.4 Pt	4853.1 11.7 Vh	4887.5 11.9 B
074922 U GEMINORUM—		4854.2 11.7 Ch	4887.5 11.7 Pt
4873.6 13.8 Cd	4884.7[13.8 B	4858.0 11.7 Ch	4888.5 11.7 Ie
4875.6 14.0 B	4885.6 14.0 B	4858.2 11.5 L	4889.5 11.5 B
4877.6 14.0 B	4886.7 14.0 B	4859.3 11.7 L	4891.5 11.6 Ie
4878.6[13.7 B	4887.6 14.0 B	4867.2 11.5 L	4892.5 11.8 Pt
4879.6[13.3 Ie	4888.6 14.0 Ie	4869.3 11.9 L	4893.5 11.5 Cl
4880.6 13.9 B	4889.6[13.7 B	4870.3 11.8 L	4893.5 11.6 Ie
4880.6 14.1 Cd	4890.6[13.7 B	4871.2 11.7 L	4894.9 10.4 Pt
4881.6[13.7 B	4891.6[12.4 Ie	4871.5 11.7 B	4896.5 9.1 Pt
4882.6 14.0 B	4892.6[13.4 B	4872.6 11.6 Cl	4898.5 8.6 Pt
4883.6[13.7 B	4894.6[12.4 B	4873.5 11.7 Pt	

Total observations, 1385; Total variables, 306; Total observers, 31.

"Cb"; Clement, "Cl"; Ebert, "Eb"; Ensor, "En"; Gaebler, Gb"; Hama, "H"; Houghton, "Ht"; Iedema, "Ie"; Jones, "Jo"; Kohl, "Kl"; Kurtz, "Kz"; Lacchini, "L"; Leavenworth, "Lv"; Miyajima, "Mj"; Mrs. Morris, "Ms"; Messrs. Peltier, "Pt"; Rowley, "Rw"; Smith, "Sm"; Watkins, "Wk"; Watson, "Wa"; White, "Wb"; and Yalden, "Ya".

LEON CAMPBELL, Recording Secretary.

February 3, 1927.

GENERAL NOTES.

Dr. Charles D. Walcott, secretary of the Smithsonian Institution, died on February 9 in the seventy-seventh year of his age. (*Science*, Feb. 18, 1927.)

Dr. Charles G. Abbot, director of the Astrophysical Observatory of the Smithsonian Institution, gave a lecture on "The Sun as the Fountain of Life," at the Case School of Applied Science, on January 11. (*Science*, February 4, 1927.)

Professor Ejnar Hertzsprung, of Leiden University, Holland, and Professor Boris Gerasimovich, of the University of Kharkow, Ukraine, are doing research work at the college observatory at Harvard University. (*Science*, February 4, 1927.)

Dr. T. C. Chamberlin, emeritus professor of geology at the University of Chicago, now in his eighty-third year, was the guest of honor at a luncheon given by eighty students and friends, in connection with the recent meeting of the Geological Society of America in Madison, Wisconsin. (*Science*, Feb. 18, 1927.)

Dr. H. H. Turner, Savilian professor of astronomy at Oxford University, has been awarded the Bruce Gold Medal of the Astronomical Society of the Pacific for 1927. The medal will be presented to Dr. Turner in San Francisco on April 11. Dr. Turner will give a series of twelve lectures at the University of California beginning on March 21. (*Publ. of the A. S. P.*, February, 1927.)

Dr. P. W. Merrill, of the Mt. Wilson Observatory, was elected president of the Astronomical Society of the Pacific for 1927 at the annual meeting on January 29. Other officers elected were: Dr. J. H. Moore, First Vice-President; Mr. A. L. Black, Second Vice-President; Mr. C. S. Cushing, Third Vice-President; Mr. C. H. Adams, Secretary-Treasurer. (*Publ. of the A. S. P.*, February, 1927.)

Dr. Helen Barton has been appointed professor of mathematics and head of the department at Alabama College; which is a State College for Women at Montevallo, Alabama. (*The American Mathematical Monthly*, Feb., 1927.)

Professor W. L. Hart has been appointed chairman of the Department of Mathematics in the College of Science, Literature, and the Arts at the University of Minnesota to succeed Professor W. H. Bussey who resigned the chairmanship so that he might devote more time to his duties as Assistant Dean and as Editor-in-Chief of the American Mathematical Monthly. (*The American Mathematical Monthly*, January, 1927.)

Dr. Samuel G. Barton, assistant professor of astronomy at the University of Pennsylvania and acting director of the Flower Observatory, has been elected president of the Camden Astronomical Society, to succeed Dr. John A. Miller, director of the Sproul Observatory of Swarthmore College. The society includes in its membership professional and amateur astronomers in the Philadelphia region. (*Science*, February 4, 1927.)

Professor Frank Schlesinger, director of the Yale Observatory, has been awarded the Gold Medal of the Royal Astronomical Society for his work on stellar parallaxes. This award was announced at the meeting of the Society on January 14. Professor Schlesinger was also chosen to deliver the first in a series of lectures on a "Foreign Lectureship" foundation, established last year through a gift by the President of the Society, Dr. J. H. Jeans, for endowing such a lectureship. This lecture was delivered on Friday, February 11.

Some Recent Occulations Observed at Leonia, N. J.—The observations were made at my observatory, Lat. 40° 51′ 50″ N, Long. 73° 59′ 19″ W, with a four-inch telescope, and a stop watch. Rate of time piece was determined by Arlington time signals.

Date	Star	Immersion	Emersion
		h m s	h m s
Dec. 11, 1926	290 B. Aquarius	17 17 33 E.S.T.	17 59 15.0 E.S.T.
Dec. 12, 1926	24 B. Ceti	18 9 44.8 "	19 27 35.6 "
Jan. 8, 1927	BD—6°6356	20 50 2.4 "	
Jan. 8, 1927	30 Piscium	21 9 21 "	
Jan. 28, 1927	Saturn	7 16 43.3 "	(center of disc)

All predictions for above made by means of the General Diagram of Professor Wm. F. Rigge.

J. Ernest G. Yalden.

Leonia, N. J., January 30, 1927.

Summary of Sun Spot Observations of Mount Holyoke College, 1926.

Month	No. of Obs.	North of Equator: No. of Groups	North of Equator: Av. Lat.	South of Equator: No. of Groups	South of Equator: Av. Lat.	Av. No. at one Obs.	New Groups
January	17	3	+21°7	6	—19°5	3.35	9
February	11	4	26.0	4	13.2	3.27	6
March	15	7	25.4	9	16.8	4.67	16
April	17	8	17.4	9	15.2	3.65	17
May	17	9	17.3	5	17.8	4.00	13
June	8	5	19.0	5	16.6	5.38	11
September	4	4	19.5	5	18.0	4.75	10
October	16	7	20.1	11	15.4	5.25	16
November	18	9	19.2	12	15.6	4.61	19
December	11	10	+19.4	13	—16.0	5.82	19
Total	134	66		79			136

Average number at one observation	4.37
Average latitude of groups north of equator	+20°22
Average latitude of groups south of equator	—16.27
Number of days observed without spots	0

Most of the observations were made by Miss Hazel Burton.

Anne S. Young.

John Payson Williston Observatory.

Julian Day Calendars.—A very convenient calendar giving both calendar dates and Julian Days for each day of the year has been printed by Mr. J. H. Skaggs, 830 Athens Ave., Oakland, Calif. Observers who have occasion to use such a calendar may obtain copies by applying to Mr. Skaggs.

Amateur Astronomers in Los Angeles.— Last summer the idea arose simultaneously in the minds of three amateur telescope makers that it would be desirable to form a society of men interested in this work in this city. The *Scientific American's* nation-wide poll of those interested in building a telescope had revealed a large number in Los Angeles.

I was appointed to carry out the arrangements, so I wrote for and received from the *Scientific American* that part of their mailing list concerned with Los Angeles and its environs. It comprised some sixty names. We can hardly thank that magazine, and particularly Mr. Ingalls, enough for their kind interest and assistance in making our proposed society a fact. A card was mailed to everyone whose name was on the list telling of the time and place of meeting. In addition, Dr. Mars Baumgardt, to whom we also owe a debt of thanks, announced the information regarding our meeting over the radio during his Wednesday night lectures on astronomy.

It was very gratifying to have at our first meeting thirty-two men. A committee was appointed to draw up a constitution. We were fortunate in having an attorney on our committee and under his guidance an excellent constitution was written. This constitution was adopted at the next meeting which occurred in December when thirty-eight men put in an appearance despite the fact that we had experienced a heavy rain all day. After the adoption of the constitution the officers were elected and then the meeting was adjourned to be followed by discussion among the members who find thus a method of airing their troubles and getting advice from someone who has experienced the same troubles and overcome them.

At our third (January, 1927) meeting we had no less than forty-eight in attendance. This meeting was so full of business that a detailed account would almost fill this magazine. A hasty survey shows plans for trips to Mt. Wilson, to Mt. Lowe with its sixteen-inch Clark refractor, the Clark Observatory in Los Angeles, plans for publicity, and many others; but most important of all, the appointment of a committee to select and rent a building to be used as a shop and meeting place for all the members. Here we can be as dirty as we please and work as late or as early as we wish.

Our mailing list now numbers over one hundred names and we have had sixty-seven different men at our three meetings.

The name of this organization is the "Amateur Telescope Makers' Society," and its meetings are held the second Wednesday of every month in the Science Seminar Room of the Los Angeles Public Library.

We would be glad to answer any inquiries regarding its organization or its activities. Such letters should be addressed to Mr. Charlton F. Chute, 3401 South Flower St., Los Angeles, Calif.

CHARLTON F. CHUTE.

Science by Radio.—On Friday, January 21, station WTAM, Cleveland, began broadcasting a series of twenty lectures on scientific topics. One lecture will be given each Friday evening at 7:15, Eastern Standard Time, until June 3 when the series will be terminated. The lectures are sponsored by four colleges of northeastern Ohio, namely, Baldwin-Wallace, Kent State, Case, and Mt. Union. The lectures will cover parts of Astronomy, Chemistry, Physics, Biology, and Psychology. It is planned to award suitable certificates to those who listen to these lectures, and who meet certain qualifications.

Fellowship in Astronomy.—There will be a fellowship in astronomy at Goodsell Observatory available in September. Stipend $500 for the college year. Open to properly qualified college graduates. Applications should be in the hands of the undersigned by April 15.

E. A. FATH,
Northfield, Minn.

The Southern Cross Observatory opened January 1 with five 5-inch Clark refractors. The observatory was founded by S. Lynn Rhorer of Atlanta at Miami, Florida, in 1923, and has since that time offered free use of its equipment to the public of Miami during the months of January, February and March of each year. An invitation is extended to visitors with some knowledge of the science to lend their assistance at the telescopes. Any interested reader of POPULAR ASTRONOMY who expects to visit Florida this winter is urged to devote some of his time to the work, which has become so great as to demand a large staff at the instruments. On several evenings last winter an attendance of 2,000 was reached. Dr. Shapley is expected to be present again this year, as will be also William Tyler Olcott, Clarendon Ions, and John H. Chase. Mr. Chase will offer his lecture with moving pictures of astronomical interest, and it is hoped to supplement this with lectures by other visitors. The new University of Miami, opened in October, has found its astronomical lecture course given by James J. Marshall, the most popular in the public extension work and will cooperate with the Observatory. No difficulty will be found in locating the Observatory, as it has a daily item in the newspapers.

A Misunderstanding. — In *L'Astronomie* for August, 1926, an amusing experience of Mr. M. F. Lamech of Corfu, Greece, is related by himself as follows: "One evening while engaged in studying the sky I received a visit from a group of persons somewhat advanced in years, who requested to be permitted to see the stars. The idea came to me to show Saturn to them. One of the visitors approached the telescope, inspected it, carefully studying its mechanism, and finally seated himself before the telescope pointed at the planet. A half hour passed without a word. He looked eagerly. I lost patience. 'Well,' said I, 'Why are you waiting?' The gentleman did not answer. He came down from the telescope and said to his companions, 'This Frenchman is a jester; he is deceiving us; he is a fraud.' Vexed as was natural, I followed him. 'Excuse me sir,' said I with legitimate ire, 'What is it you say?' 'Leave me sir. You are deceiving the world with your charlatanism.' 'Sir explain yourself,' I insisted a bit more angered. 'Leave me,' said he, 'or I will strike you,' and he brandished the cane which he had in his hand. I saw that he meant it. My anger re-doubled and I seized the man by the collar compelling him to explain. With a muffled voice and still delivering a few blows with his cane, the poor man explained as follows: 'Why, you deceiver, did you place your hat in the telescope in order to make the world believe that it is a star?' I understood his mistake and released my hold and begged him to compose himself and sought to persuade him of the existence of the rings of Saturn. 'No! No!,' he cried, 'Your are deceiving us; it is your hat.'"

Brevity in Astronomy.—The following note appeared in *The Observatory* (London) for November, 1926:

"One well-known astronomer received a telegram from the editor of a daily paper as follows: 'Would you state very briefly your idea of a Martian, presum-

ing you suppose such a being to exist? Should be most glad to publish your news.' Twelve words were prepaid. The necessary address absorbed five, and the selected seven remaining were, 'Martian sky so clear Martians all astronomers.' But the editor did not print the reply."

This suggests a similar experience as related to us recently by the director of one of the largest of American observatories. In this instance the request was from a metropolitan newspaper for a discussion of the question as to whether Mars is inhabited. Three hundred words were permitted. The astronomer telegraphed the following reply: "Three hundred words unnecessary. Three are enough. No one knows."

BOOK REVIEWS.

The North American Almanac for 1927, published by the North American Almanac Company, Chicago. Fifty cents.

The new edition of this publication is quite up to the standard of excellence which has been maintained in previous years. There are the usual astronomical data, but, besides the usual holidays, are also given numerous anniversaries of historic events such as the Habeas Corpus Act by the English Parliament, the Charge of the Light Brigade, and Cornwallis' Surrender, ending the Revolutionary War. This information can all be gained by a glance at the page giving the days of the month. The reading material, as in the past, is very interesting. There are popular articles on astronomy by Dr. Frost of the Yerkes Observatory, Dr. Pettit of Mount Wilson Observatory, Dr. Slocum of Van Vleck Observatory, and the late Professor Howe of Denver University, and others. Indeed, there are interesting articles on many diverse subjects such as, "Ways of Telling Time—Ancient and Modern," "The Romance of the Father of Waters," (The Mississippi River), "Twelve Historic North American Indians," etc.

The publishers are to be congratulated on the continuation of the publication of such a fine collection of popular reading material in such a convenient form.

Tabelle der Hauptlinien der Linienspektra aller Elemente, by H. Kayser, 798 pages (Julius Springer, Berlin, 1926. Price 24 marks).

This table of wave-lengths needs no other recommendation to spectroscopists than the statement that it comes from Professor Kayser of Bonn. For others the following brief description may suffice to indicate its value. It contains the wave-lengths in International Angstroms of approximately 19000 lines in the spectra of the various elements within the range of 90000 A to 124 A, the name of the element, the degree of ionization, if known, and the intensity of the line in the arc, spark, or vacuum tube. The values of the wave-lengths given range from units to thousandths depending upon the accuracy to which the wave-length of the particular line is known. Two columns are printed on each page, and generous margins on both sides give ample room for additions and other changes. This table is to be considered as replacing a similar table of about one-half the number of lines in volume 6 of *Kayser's Handbuch der Spectroskopie.* It contains latest information available in the literature published to March, 1926.